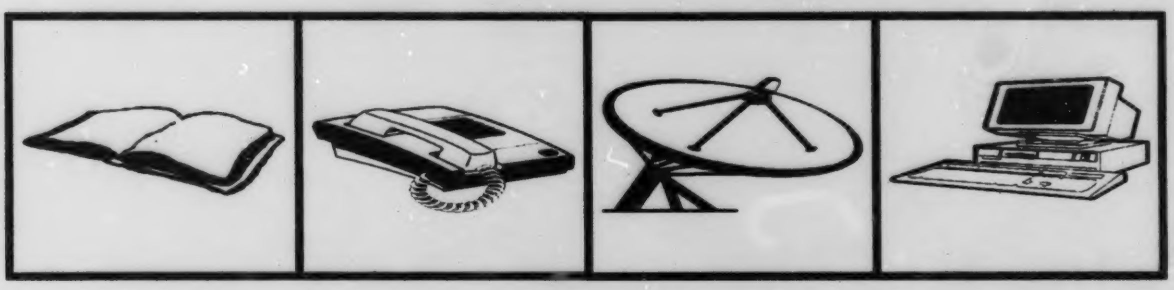
Technology-Enhanced Learning

Phase I: Discussion Paper
on the Integration of Technologies
in Post-Secondary Education and Training
for Saskatchewan

Executive Briefing



Prepared by the
Technologies in Learning Working Group

December 1997

Executive Briefing

Prepared by the Province's Education and Training Partners
with the Assistance of
Saskatchewan Post-Secondary Education and Skills Training

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Minister of Post-Secondary
Education and
Skills Training

Legislative Building
Regina, Canada [illegible]
(306) [illegible]

January 30, 1998

Dear Colleague:

Education and training are good investments. Increasingly, investing in these areas includes investing in technology. I am pleased to recommend for your consideration the enclosed paper, entitled *Technology-Enhanced Learning Phase I: Discussion Paper on the Integration of Technologies in Post-Secondary Education and Training for Saskatchewan.*

This paper was prepared by a group of practitioners nominated by our education and training partners at the request of the Department. It articulates the key issues and challenges we face in integrating technologies into our learning system. It offers some recommendations and outlines key priorities for the coordinated action that is required to achieve this objective.

The paper itself is not intended to be a blueprint for future direction. Rather, it prepares the groundwork for all who will share in developing our collective capability.

I encourage you to review the material and to provide feedback to help reach our mutual goal of providing high quality, flexible and accessible learning opportunities for the people of Saskatchewan. Your perspective will help to shape our learning environment well into the 21st Century. A common vision will enable us to engage fully in a global society that thrives on the creation and sharing of knowledge.

Let me take this opportunity to thank the Technologies in Learning Working Group for dedicating their time and talents to the preparation of this discussion paper. I share their interest in your views, and look forward to your thoughtful response to the concepts and challenges they have articulated for us.

Sincerely,

Joanne Crofford

Joanne Crofford
Minister of Post-Secondary Education
and Skills Training

102-03913/

Technology-Enhanced Learning

Phase I: Discussion Paper on the Integration of Technologies in Post-Secondary Education and Training for Saskatchewan

Executive Briefing

This is a condensed version of a Discussion Paper written by a working group nominated by the province's education and training partners, upon the invitation of the Deputy Minister of Post-Secondary Education and Skills Training. The Paper represents Phase I of the recommendations for coordinated action resulting from a policy framework planning session on technologies in learning for Saskatchewan's post-secondary education and training system, hosted by the Department in May 1997. It is presented to the Department and the participants of that session, for further discussion among their colleagues and constituents and feedback for further consideration.

The Working Group members are:

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Information on how to forward comments about the Discussion Paper is provided in Section 5 of the main document, **Feedback Requested**.

Technology-Enhanced Learning

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Executive Briefing: Technology-Enhanced Learning

The following is a synopsis of ***Technology-Enhanced Learning: Phase I: Discussion Paper on the Integration of Technologies in Post-Secondary Education and Training for Saskatchewan*** (December 1997).

1 Need for a Strategic Plan

A global communication network and rapid technological advancements are significantly altering everyday life, work and decision-making processes. This has an impact on education and training systems worldwide.

People are demanding more high quality, flexible, relevant learning opportunities, and convenient access to expertise according to their needs. Academic institutions are challenged to provide support for learners and faculty to use communications technologies. If they do not respond, they risk losing opportunities to other institutions. At the same time, they must ensure appropriate development and use of technology for learning. In the face of these challenges, education and training partners are calling for coordinated planning and action to ensure appropriate integration of technologies in learning for the province.

In May 1997, Saskatchewan Post-Secondary Education and Skills Training (PSEST) hosted a planning session to review current policies and practices and advise on appropriate action. At the close of the session, a working group was formed to prepare a discussion paper exploring further the vision, mission, principles, issues and priorities initiated there, and recommending options for a coordinating structure to complete the strategic plan. The Working Group has pursued this task, along with an environmental scan to create the context for developments in Saskatchewan.

The proposed framework for developing a strategic plan to integrate technologies in learning begins with a statement of vision, mission, principles and desired outcomes. The issues and challenges explored in this context are summarized in four categories: ***Learning Culture***, ***Infrastructure and Delivery***, ***Coordination***, and ***Management***. Following this is a brief outline of the current situation. Relevant administrative structures in other jurisdictions are listed in **Attachment A**. The recommendations and priorities for coordinated action are summarized according to the categories of issues and challenges. The final section poses key questions for consideration and feedback.

2 Proposed Framework for Developing a Plan

2.1 Vision

Serving the learning and career needs of all provincial residents by using technology to ensure quality and accessibility, thereby enhancing intellectual, social and cultural well-being and enabling participation in the province's research activities, economic development and prosperity.

2.2 Mission

To improve and enable learning through appropriate use of technologies.

2.3 Guiding Principles

Accessibility and collaboration are understood to be implicit in all principles:

Quality, **Equity**, **Choice**, **Coherence**, and **Sustainability**

2.4 Desired State

The following specific outcomes are suggested to move from vision to reality:

- high quality, relevant learning opportunities, based on needs of learners;
- flexible programs in various formats to support appropriate access;
- a common understanding of vision, mission, and strategic directions;
- coordination among K-12 and post-secondary education and training sectors, network service providers, libraries, software and media specialists, and industry partners;
- communities and employers helping to identify needs and deliver programs;
- investment in technologies to enhance learning for the long term;
- institutions, residents, and government contributing to a global learning culture;
- a workforce skilled to compete and thrive in a knowledge-based society; and
- faculty adept at using a variety of technologies as instructional media.

Success in achieving the vision will depend on the sector's ability to build on strengths and take advantage of opportunities, while overcoming obstacles.

3 Current Situation

A scan of the current availability and use of technologies, in Saskatchewan and elsewhere, indicates strong interest in multi-mode approaches to teaching and learning. Saskatchewan already has the necessary foundation with its fibre optic and satellite network infrastructure, its long history of outreach and distance education, and its collaborative mechanisms to enable development. In addition, the strategies and administrative structures emerging from other jurisdictions suggest that collaboration and quick action are necessary. A brief outline of administrative structures in other jurisdictions is provided in **Attachment A**.

4 From Issues to Action: Learning Culture, Infrastructure and Delivery, Coordination, and Management

4.1 Issues

The issues, needs and opportunities identified at the May 1997 Planning Session are grouped in four general categories, as follows:

Learning Culture	Infrastructure and Delivery	Coordination	Management
Trends	Learning Needs and Content	Policies	Participation and Roles
Equity and Access	Design, Development and Delivery	Resources	Functions and Structures
Learner Role, Training, and Support	Networks		
Instructor Role, Training, and Support	Hardware, Software, and Infrastructure		

Below is a summary of these issues, as explored more fully in the Discussion Paper.

4.1.1 Learning Culture

Trends

- Popular demand: flexible access; interest in programs delivered from out-of-province.
- Role of the institution: from information providers to emphasis on shaping information and constructing knowledge, developing creative and critical thinkers, and assessing learning.

- Consumerism: demand for more differentiated goods and services, wherever available.
- Pervasiveness of technology: increasing access to electronic media in everyday life.
- Pressure on public institutions: greater productivity and higher quality service.
- Competition: globalization of education — public and private sectors producing educational material for a world marketplace.

Equity and Access

- Increased access:
  - directly related to increased funding;
  - could result in no net increase if funds are reallocated from traditional instruction;
  - could increase effectiveness and efficiency.
- Equity of access:
  - could enable participation of currently excluded social groups;
  - exclude those who lack access to technology or skill in use;
  - could increase access for rural, northern, and Aboriginal communities, or for people with disabilities, or home, work, and family obligations.

Learner Role, Training, and Support

- Learner skills and attitudes needed: critical thinking; managing volumes of information; computer literacy; willingness to interact with material, other learners, and instructors.
- Learner support: level, type, and methods, such as access to information on employment, careers, and programs in electronic formats, in rural and remote locations; province-wide online library services; training in use of technologies; help-line, etc.
- Social dimension of learning:
  - concern about isolation or lack of context for learning;
  - critical mass of learners required to create a social dimension;
  - interactivity dependent on medium, such as a "virtual forum," or support available in community or workplace.

Instructor Role, Training, and Support

- Discouraging factors:
  - lack of time and specific training to understand and exploit technologies for learning;
  - lack of incentives; activity considered peripheral to academic culture.
- Ways to encourage use:
  - technology readily available, reliable, flexible, and easy to use, so as not to interfere with teaching and learning processes;
  - strong "champions" within the system to effect cultural change;
  - learning centres for instructional design and technical support, training or symposia;
  - strong reward or compensation system.
- Instructor role: shift from dispenser of knowledge to manager of learning; emphasis on instructional strategies and team approach to design, production, and delivery.

4.1.2 Infrastructure and Delivery

Learning Needs and Content

- Characteristics of Saskatchewan learners: sensitivity to Aboriginal culture, language, and education and training needs.
- Best applications: integration dependent on learning context; need mechanisms to identify diverse needs and delivery formats; research on "best practices."
- Course purchase versus development:
  - how to determine when development is appropriate (e.g., focus on uniqueness, expertise, "centres of excellence");
  - fear of falling behind or becoming dependent on external suppliers.

Design, Development, and Delivery

- Instructional design:
  - principles and practices not yet established;
  - research and experimentation required;
  - more practitioners and training in use of technology needed.
- Selecting appropriate technologies and use: varied and continually evolving technologies need established guidelines and criteria, based on:
  - content type
  - learner characteristics
  - teaching strategies
  - infrastructure capacity (wiring/cabling, hardware/software, technical support)
  - development, production, and distribution costs
  - revenue potential
  - administrative considerations.
- Costs and cost-effectiveness:
  - difficult to compare for various media, but applications are not necessarily cheaper;
  - development costs can be offset by quality, access or large-scale delivery over time.

Networks

- Terminology:
  - "networks" can be human, institutional, or technology "networks" (e.g., fibre optic cable, satellite, or computer-based systems with varying points of control);
  - term suggests coherence — seamlessness, integration, and articulation.
- State of a provincial network:
  - telecommunications access not yet available everywhere;
  - libraries are considered essential to academic programs, yet only one-third are connected;
  - need to define types of carriage (e.g., audio, video, data);
  - should be built on existing structures (e.g., fibre optic cable, satellite television networks, regional colleges network and Community Access sites).

Hardware, Software, and Infrastructure

- State of the province's infrastructure:
  - continued upgrading of existing telecommunications systems;
  - fibre optic lines or microwaves link five cities, three schools, SIAST and the universities;
  - not all public education facilities are equipped to provide access to the Internet;
  - SCN provides satellite television channels for public broadcast and closed-circuit training, but needs upgrading to support other delivery mechanisms;
  - access to telephone, radio, cable television, videocassette recorders, fax machines, and tape players at or near most homes, except in isolated areas;
  - analog receiving dishes are common and digital receiving dishes becoming available in rural Saskatchewan;
  - school computers are not always adequate for contemporary applications;
  - modern computers and peripherals are increasingly common in middle class homes;, but Internet access not yet widespread.

4.1.3 Coordination

Policies

- Role of technology: strong majority view that learning needs, not technology, should drive developments, although technology's role is recognized; industry standards are considered the key driver in apprentice trades.
- Links to other government policies: should include:
  - PSEST — Multimedia Learning Strategy, Training Strategy, University Renewal, SCN videoconferencing, SIAST plans for a "virtual campus";
  - Saskatchewan Education — Multimedia Learning Strategy, Evergreen Curriculum;
  - Economic and Co-operative Development — promotion of IT and new media industries through Partnership for Growth, Enabling Prosperity and university IT research parks;
  - SaskTel — Sask.Connect and Advanced Interactive Solutions strategies;
  - Federal government — Community Access Program, SchoolNet, Office of Learning Technologies, Networks of Centres of Excellence in Telelearning, Information Highway Advisory Council;
  - Other jurisdictions (see **Attachment A**).
- Ranking media and technologies for learning:
  - no one mechanism suits all needs;
  - emphasis on choice, flexibility, appropriate use, and a multi-mode approach.

Resources

- Relative priority: need strong commitment of resources and long-term strategic investment.

4.1.4 Management

Participants and Roles

- Partners: actively involved in development, including:

  - education and training sector — PSEST, Provincial Apprenticeship Board; public post-secondary institutions; Aboriginal institutions; faculty and instructional designers; Saskatchewan Education, including the Correspondence School; School Divisions;
  - Economic and Co-operative Development, including funding agencies;
  - provincial and regional libraries; private sector trainers;
  - information technology and telecommunications agencies (e.g., SaskTel, SCN); new media and software development industries;
  - Federal government, including Human Resources Development, Office of Learning Technologies, and Industry Canada, etc.
- Partner roles and responsibilities:
  - CEO level commitment;
  - co-operation and responsiveness to stakeholder needs and concerns;
  - advisory, executive, and/or supportive roles for the following:
    - policy development, coordination and implementation;
    - content design, production and, promotion;
    - instruction and human resource development;
    - infrastructure and network development, equipment, facilities and access;
    - financial resources.
- Stakeholders: affected by but not contributing to design, development, or execution — students, employers, employees, special interest groups, and regional education partners.
- Stakeholder roles and responsibilities: issues and needs identification; financial and in-kind support; feedback and evaluation.

Functions and Structures

- Leadership functions and style:
  - collective approach, with common objectives, priorities and communication channels;
  - support development of learning resources without impeding work of practitioners.
- Required structures:
  - coordinating body to ensure system-wide collaboration and coordination;
  - telecommunications network to support a multi-mode approach.

4.2 Challenges and Directions for Change

A closer look at the issues reveals a number of challenges faced by the province and the education and training institutions in integrating technologies for learning. These need to be addressed in a strategic plan to form the foundation for coordinated action. For easy reference, the challenges are grouped in the four categories corresponding to the issues. They are summarized in the table below.

Learning Culture	Infrastructure and Delivery	Coordination	Management
Develop positive attitudes and professional practices.	Identify course needs and rank development projects.	Secure broad government support at policy level.	Determine appropriate management style, processes, and structures.
Secure strong institutional commitment.	Select appropriate media and technologies.	Align with internal policies, initiatives, and agencies.	Clarify institutional roles and responsibilities.
	Define, design, and build a learning network.	Align with external policies, initiatives, and agencies.	
		Develop methods of cost estimation and funding.	
		Redeploy existing resources.	
		Determine additional resources required.	
		Secure financial support for all aspects of development, including courseware, operations, and infrastructure.	

4.3 Recommendations and Priorities

The Discussion Paper contains eleven recommendations, including key priorities for province-wide coordinated action to integrate technologies in learning. Recommendations #1 to #4 propose that the sector endorse the vision, mission, principles and desired end state articulated in the discussion paper. Recommendations #5 and #6 refer to use of the background material to complete a strategic plan for enhancing learning through technology.

Recommendation #7 lists eight key priority areas for developing a strategic plan, as follows:

1) Co-operation across the system to ensure efficient planning and operations
2) Training to develop skills and experience in use of technology
3) Infrastructure to support use of technology in learning
4) Commitment to sustain the initiative
5) Resources to support technology-enhanced learning
6) Expanded role for SCN in enhancing a learning network
7) Integration with the K-12 sector in facilities, infrastructure, program development
8) Global competitiveness.

Recommendations #8 to #11 specify the functions and structures needed to advance the strategy. These include three immediate actions that directly involve the Department and key partners, decisions on which will affect the course of events. These are as follows:

1. Form a Partners' Council or some such body, chaired by PSEST, to complete the strategic plan, advise on policy, facilitate communication and collaboration, and develop expertise in technology-enhanced learning.
2. Continue existing mechanisms for coordinating and allocating resources for technology-enhanced learning and restore funding to 1995 level.
3. Increase funding and staffing for the Department unit responsible for TEL.

The recommendations and key priorities are described above as they occur in the Discussion Paper. For ease of reference, the following table provides an overview to illustrate how these might relate to the issues and challenges.

Issues	Challenges/Directions	Recommendations/Priorities
Learning Culture **Trends** • Demand for flexible access and formats • Emphasis on shaping knowledge and critical thinking • Increasing availability of technology • Pressure on productivity and quality • Globalization of education **Equity and Access** • Increased TEL depends on funding • Would TEL help disadvantaged groups or further exclude those who lack access or skills? **Learner Role, Training, and Support** • Need for training, support, on-line services, etc. • Concern about isolation and lack of interactivity **Instructor Role, Training, and Support** • Need for accessible, reliable, flexible, tools, "champions," training, incentives, support, etc. • Emphasis on facilitation, team design, and delivery	• Develop positive attitudes and professional practices • Secure strong institutional commitment	7-1 **Institutions** to commit resources to collaboration, infrastructure, and system plan 7-2 **Institutions** to assess and share information on training needs, assets, skills, and experience 7-5 **Institutions** to use existing resources to lever funding from governments, private sector, other provinces, and international sources; and secure long-term funding to develop and implement strategies 7-8 **Institutions** to: • collaborate with other institutions and provinces in common areas • market strengths, using revenue to develop essential programs • focus international efforts on Internet • share international marketing to create opportunities and reduce costs

Issues	Challenges/Directions	Recommendations/Priorities
Infrastructure and Delivery		
Learning Needs and Content • Sensitivity to Aboriginal needs • Uses appropriate to learning context, needs, "best practices" **Design, Development, and Delivery** • Focus on uniqueness and strengths; gain expertise • Need research and training in instructional strategies • Need guidelines and criteria to assess content, learner needs, teaching strategies, infrastructure, technical support, costs, revenue potential • Cost-effectiveness — quality, and long-term delivery may offset costs **Networks** • Term suggests coherence, seamlessness, integration • Need to connect institutions, libraries and individuals; identify media (audio, video, data); build on existing networks (fibre optic, satellite, regional/community sites) **Hardware, Software, and Infrastructure** • Systems being continually upgraded • Fibre optic or microwave links in a few cities, schools, SIAST, universities; Internet access not widespread • SCN needs upgrading to support multi-mode • Home access to telephone, radio, cable television, videocassette recorders, fax machines, and tape players, common except in isolated areas • Analog receiving dishes common; digital now available • Computers in schools not always adequate; modern computers more common in homes	• Identify courseware and support needs and set priorities for development • Select appropriate media and technologies • Define, design, and build a learning network	7-6 **SCN** to support and manage province-wide access to multi-mode infrastructure, with audioconference bridge, computer networks, etc. 7-3 **Institutions** to identify infrastructure gaps and recommend action by March 31, 1998 7-3 **Institutions** and **PSEST** to acquire resources and commit to action by June 30, 1998

Issues	Challenges/Directions	Recommendations/Priorities
Coordination **Policies** • Developments to be driven by learner and industry needs, not technology • Need to link with policies and strategies of PSEST, other government departments, SaskTel/SCN, federal government and other jurisdictions • Choice of media and technology driven by content needs, and multi-mode approach **Resources** • Need strong commitment of resources and long-term strategic investment	• Secure broad government support at policy level • Align with PSEST policies, initiatives, and agencies • Align with external policies, initiatives, agencies and departments • Develop methods of cost estimation and funding • Redeploy existing resources • Determine additional resources required • Secure financial support for developments, including courseware, operations, and infrastructure	1,2,3,4 **Partners** to endorse the proposed framework to develop a strategic plan 7-4 **Partners** to create a comprehensive plan to achieve the vision, align with government strategies and priorities, gain community endorsement, and recommend it to government 8 **Partners** to form a Council to develop strategic plans; advise on policy and infrastructure, facilitate collaboration and communication with stakeholders; develop collective expertise, and recommend resources to realize the plan 5,6 **Partners** to use issues analysis and environmental scan to inform planning 7-7 **Partners** to integrate planning with K-12 sector (e.g. facilities, network infrastructure, equipment, programs, and training)

Issues	Challenges/Directions	Recommendations/Priorities
Management **Participants and Roles** • Key partners include education and training sector (K-12 and PSEST); Economic and Co-operative Development; libraries; telecommunications agencies; new media and software developers; and federal government • Partners to provide senior level commitment; co-operation; responsiveness; advice, action, and/or support for policy, content, instruction, infrastructure, network development, equipment, facilities, access and financial resources • Stakeholders affected by but not contributing to design, development, or delivery: students, employers, employees, interest groups, and regional partners • Stakeholders to identify issues and needs; provide financial and in-kind support, feedback and evaluation **Functions and Structures** • Need common objectives, priorities, communication and support without impeding development • Need advisory bodies to ensure system-wide collaboration • Need a multi-mode telecommunications network	• Determine appropriate, processes, and structures to manage TEL • Clarify institutional roles and responsibilities	9 Until a Council is formed and develops a plan, **PSEST** to continue existing means to allocate program development and support resources 10 Until a Council develops a plan, **PSEST** to continue "championing" initiatives and restore the Program Development and Support Fund to 1995 level 11 **PSEST** to take immediate steps to improve substantially the funding and staffing for the unit responsible for technology-enhanced learning

5 Questions for Consideration and Feedback

The Discussion Paper is presented to the participants of the May 1997 Planning Session and their respective organizations to stimulate further discussion and a coordinated response. A series of questions is posed on the broad range of issues, challenges, recommendations and key priorities outlined in the paper. Responses will help to formulate a province-wide strategy for the integration of technologies in learning and turn strategy into action.

5.1 Learning Culture

1. What learning needs could be addressed effectively using technologies? How should these be identified?
2. What action would be needed within academic institutions to implement a TEL strategy for post-secondary education and training?
3. What commitment can or should your organization make to advance TEL?

5.2 Infrastructure and Delivery

1. How can the relative cost-effectiveness of the various media and technologies for learning be determined?
2. How should a "learning network" be defined and structured? What key functions should it perform? What "network" models are most appropriate?
3. What agencies should build and manage a learning network? Who are the key partners?

5.3 Coordination

1. What parts of the framework proposed in this paper are appropriate for Saskatchewan's post-secondary education and training system? How should the recommendations and key priorities be ranked? What others should be included?
2. What are your organization's vision, plans and priorities for TEL? How can these be aligned with a provincial strategy or with other institutions?
3. What other government policies and initiatives should be linked with a TEL strategy?
4. What TEL models or practices can be adopted from other jurisdictions?
5. What action should be taken to implement TEL in Saskatchewan?

5.4 Management

1. What practical steps need to be taken to ensure a system-wide, collaborative approach to TEL? By whom?

2. What key functions, activities or processes must be in place to manage TEL successfully? Who is responsible for these?
3. What structures are needed to manage these? Where should they be placed?
4. Given limited resources, how should TEL be ranked among provincial and institutional priorities?
5. What are your organization's current investments in TEL? How might existing human, material, and financial resources be redeployed to support TEL?
6. How should the resources and investments of the key partners be coordinated?
7. How can the private and public sectors work together to provide resources for TEL?
8. How would TEL be advanced if there were no new resources?
9. Who are the key partners and stakeholders and what roles should they play in advancing TEL?

Copies of the Discussion Paper are being distributed to participants of the May 1997 Planning Session for circulation among their colleagues and organizations. They are asked to provide **one coordinated response per organization by April 15, 1998**.

In addition to bound copies, the Paper is posted at:

URL: **http://www.sasked.gov.sk.ca/P/TELDP/**

Attachment A:
Administrative Structures in Other Jurisdictions

A review of strategies and structures emerging in other jurisdictions indicates that others are confronted with similar issues and challenges related to the use of technologies in learning. Below is a brief outline of some activities relevant to the situation in Saskatchewan.

1 Coordinating Bodies

In some jurisdictions, a coordinating body has been established to oversee system-wide policy development, strategic planning, priority setting and implementation of technologies in learning. Such bodies are typically comprised of representatives from various constituency groups appointed by the Ministry. Some operate at arms length with a Board and staff, while others are situated within the Ministry. Some may coordinate the activities of related groups or committees. Examples include:

- **British Columbia:** A strategic plan for the non-university sector (1996) emphasized system collaboration and use of technology to increase access, quality and cost-effectiveness. A Centre for Curriculum, Transfer and Technology (C2T2) was established to coordinate technology integration and advise on the sector's telecommunications needs.
- **Manitoba:** A Task Force on Distance Education and Technology (1993) recommended community-based infrastructures and a system-wide approach to implementation. Structures include regional consortia (geographical or cultural); a Council on Post-Secondary Education to oversee system funding, accreditation and program rationalization and facilitate cross-credit first year university programs; and a Post-Secondary Committee on Learning Technologies to ensure collaboration.

2 Advisory Committees

Committees typically represent the post-secondary education and training system, and in some instances the provincial learning network agency. They are typically asked to advise partners on issues and strategies. Examples include:

- **British Columbia:** Standing Committee on Educational Technology (SCOET);
- **Manitoba:** Council on Learning Technologies representing regional consortia, K-12 and post-secondary education sectors and the provincial learning network.

3 Dedicated Distance or Technology-Based Institutions

Some institutions are dedicated solely to distance learning, and these are increasingly incorporating use of communications technologies. Examples include:

- **British Columbia:** Open Learning Agency (OLA) — supports distance and open learning across the province and elsewhere.
- **Alberta:** Athabasca University — traditionally a print-based institution, now incorporating computer-mediated instruction.
- **USA:** Western Governors University (1997) established to provide distance learning opportunities through the Internet and other telecommunications network technologies for people in rural and remote regions and the workplace — currently involves 19 states and territories and several corporate partners, and is establishing partnerships in other countries, including Great Britain, Japan, Mexico and Canada.
- **New Brunswick:** TeleCampus (1996), a "virtual campus" of TeleEducation NB, formed as part of the Canada-New Brunswick Regional Economic Cooperation Agreement to coordinate online learning for all regions and sectors involved in education and training, including public institutions, private trainers, small information technology companies, government departments and non-profit organizations; and stimulate development and delivery of technology-based learning programs and services for a worldwide market.

4 Learning Networks

Learning networks may be set up as an internal agency run by the Ministry or as an independent agency funded by the Ministry, and coordinate activities with advisory committees.
They generally provide system-wide telecommunications services to enhance learning opportunities, including access to the Internet, video transmission, secure data transfer, audio and video conferencing, and other advanced telecommunications services. Examples include:

- **British Columbia:** provincial learning network (PLNet) operated by the Ministry.
- **Manitoba:** Manitoba Education, Research, and Learning Information Network (MERLIN), a Ministry agency to provide Internet access, videoconferencing and teleconferencing, production facilities, low rate satellite time, consulting services, and training services.
- **Ontario:** Contact North — a provincial learning network agency formed under the Open Learning Strategy to provide access to secondary, college, university and general interest courses in northern Ontario, promote collaboration among post-secondary institutions, and support multi-mode approaches to increase access, effectiveness and flexibility.

- **New Brunswick:** TeleEducation NB (1993), a network of community learning centres or "electronic classrooms" created by the Ministry in partnership with local communities, education institutions and industry as part of a strategic plan for distance learning — being linked with the Community Access Program and Service NB, to provide integrated online government services.

5 Networks for Information, Research, Collaboration and Support

These are typically informal online discussion groups formed to stimulate communication and support among practitioners. Examples include:

- **Ontario:**
  - Colleges of Ontario Network for Education and Training (CON*NECT) — collaborative network to increase collaboration and adopt new technology-enhanced approaches to course delivery;
  - Network of Ontario Distance Educators (NODE) — electronic network to facilitate collaboration among post-secondary program developers, faculty, administrators, learners and private sector partnerships to support research, practice and information sharing on technology-mediated teaching and learning.
- **Federal Government:**
  - Industry Canada, Canadian Network for the Advancement of Research, Industry, and Education (CANARIE) — a high speed network among major universities and research institutes across Canada;
  - Human Resources Development Canada Office of Learning Technologies (OLT) — network of experts to advise on research and development of technologies in learning.

6 Dedicated Department Unit and Staff

Most provinces dedicate staff and units to oversee developments and support external committees or councils on technologies in learning. Examples include:

- **Manitoba:** Learning Technologies Coordinator to develop and support initiatives and the Advisory Council on Learning Technologies.
- **Nova Scotia:** unit to provide support for K-12 education.
- **British Columbia:** support structures and regional consortia to coordinate provincial planning and training in use of technologies for learning.

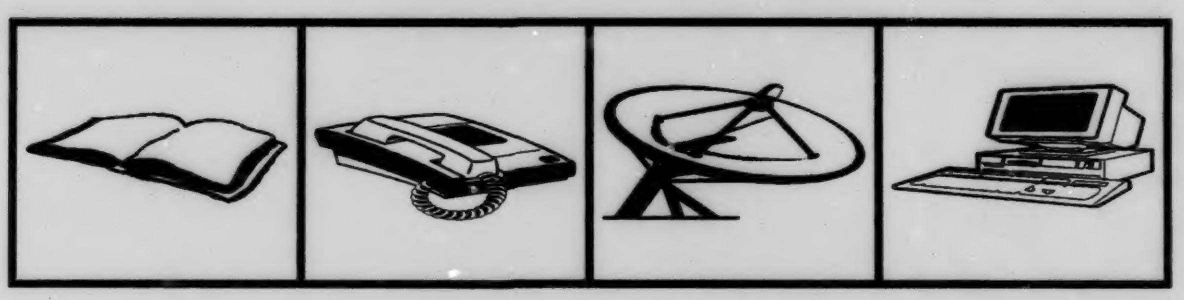
7 Funding for Technology-Enhanced Learning

Most provinces provide funding for use of communications technology to support, expand and improve teaching and learning. Funding may be provided by institution for technology integration plans, as in Alberta; by organization projects, as in Ontario; by course and program development projects, as in New Brunswick; or by specific research and evaluation projects, as is the practice of the OLT. Examples include:

- **Alberta:** Learning Enhancement Envelope — three-year $30 million technology integration fund for curriculum adaptation, distance learning programs, training in use of technology, research, learner support, and equipment.
- **Ontario:** Open Learning Strategy — funding for NODE partnerships, research, and professional development.
- **New Brunswick:** Programme Development Fund and funding for TeleCampus to develop commercially viable products and services for a world wide market.
- **Federal Government:** funding for assessment, research and testing, dissemination and sharing of knowledge (OLT); funding for SchoolNet; Information Highway Advisory Council; Community Access Program (CAP); and CANARIE (Industry Canada).

Technology-Enhanced Learning

Phase I: Discussion Paper on the Integration of Technologies in Post-Secondary Education and Training for Saskatchewan



Prepared by the
Technologies in Learning Working Group

December 1997

Prepared by the Province's Education and Training Partners
with the Assistance of
Saskatchewan Post-Secondary Education and Skills Training

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January 30, 1998

Dear Colleague:

Education and training are good investments. Increasingly, investing in these areas includes investing in technology. I am pleased to recommend for your consideration the enclosed paper, entitled *Technology-Enhanced Learning Phase I: Discussion Paper on the Integration of Technologies in Post-Secondary Education and Training for Saskatchewan.*

This paper was prepared by a group of practitioners nominated by our education and training partners at the request of the Department. It articulates the key issues and challenges we face in integrating technologies into our learning system. It offers some recommendations and outlines key priorities for the coordinated action that is required to achieve this objective.

The paper itself is not intended to be a blueprint for future direction. Rather, it prepares the groundwork for all who will share in developing our collective capability.

I encourage you to review the material and to provide feedback to help reach our mutual goal of providing high quality, flexible and accessible learning opportunities for the people of Saskatchewan. Your perspective will help to shape our learning environment well into the 21st Century. A common vision will enable us to engage fully in a global society that thrives on the creation and sharing of knowledge.

Let me take this opportunity to thank the Technologies in Learning Working Group for dedicating their time and talents to the preparation of this discussion paper. I share their interest in your views, and look forward to your thoughtful response to the concepts and challenges they have articulated for us.

Sincerely,

Joanne Crofford

Joanne Crofford
Minister of Post-Secondary Education
and Skills Training

Technology-Enhanced Learning

Phase I: Discussion Paper on the Integration of Technologies in Post-Secondary Education and Training for Saskatchewan

This paper was written by a working group nominated by the province's education and training partners, upon the invitation of the Deputy Minister of Post-Secondary Education and Skills Training. It represents Phase I of the recommendations for coordinated action resulting from a policy framework planning session on technologies in learning for Saskatchewan's post-secondary education and training system, hosted by the Department in May 1997. It is presented to the Department and the participants of that session, for further discussion among their colleagues and constituents and feedback for further consideration.

The Working Group members are:

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Information on how to forward comments about this paper is provided in Section 5, **Feedback Requested**.

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Executive Summary

Setting the Stage: Need for a Strategic Plan

> *New technologies have brought humankind into the age of universal communication: by abolishing distance, they are instrumental in shaping the societies of tomorrow . . .*
>
> **Learning: The Treasure Within, Report to UNESCO by the International Commission on Education for the Twenty-First Century**

A global communication network and rapid technological advancements are significantly altering everyday life, work and decision-making processes. Educators, learners, and institutions throughout the world are profoundly affected by this phenomenon. An understanding of such changes and their effects on education and training is fundamental to deciding how best to employ technology to enable and improve learning. Decisions need to be informed by the education and training needs of learners, as well as society's ultimate goals for education.

People are demanding more high quality, flexible, relevant learning opportunities and access to appropriate expertise in ways, places and times suited to their needs. Academic institutions are being challenged to provide opportunities for learners and faculty to use technology for learning. If they do not respond, they risk losing opportunities to other institutions. At the same time, they must ensure its appropriate development and use in the learning context.

Some developments are already occurring in a limited fashion. For nearly a decade, Saskatchewan has used satellite television and audioconferencing to deliver courses in rural communities across the province, through the regional colleges. More recently, institutions and industry partners have begun to develop technology applications through programs such as the Multimedia Program Development and Support Fund, Strategic Initiatives, Job Start/Future Skills, Industry Canada's SchoolNet and Community Access Programs, and the federal Office of Learning Technologies.

Saskatchewan, with its high quality telecommunications infrastructure, its high quality academic institutions, and a strong history of collaboration in distance education, has an opportunity to become a world leader in their application to learning. In the face of these challenges and opportunities, education and training partners are calling for coordinated planning and action.

In May 1997, Saskatchewan Post-Secondary Education and Skills Training (PSEST) hosted a planning session to begin formulating a new policy framework to guide the use of technologies for learning in the context of the present University Revitalization process and the Saskatchewan

Training Strategy. At the close of the session, a working group was formed to prepare a discussion paper exploring further the vision, mission, principles, issues and priorities that took shape there, and recommending options for a coordinating structure to develop a strategic plan. This document is the result of that working group's efforts and follows its original guidelines. In addition, it assesses the current state in Saskatchewan and elsewhere to help portray the context for technology-enhanced learning developments in Saskatchewan.

Organization of the Discussion Paper

This discussion paper lays the groundwork for strategic planning by articulating the issues, challenges and priorities within the province's education and training system for the integration of technologies in learning. The Working Group's recommendations are identified as they occur throughout the paper, but for convenience they are compiled as a **List of Recommendations**, immediately following this **Executive Summary**.

The first section describes the origins of the planning process and the specific mandate of the Working Group that prepared it. Section 2, **Creating the Ideal Future**, makes specific suggestions to reflect the spirit and intent of the framework suggested by the larger group at the May Planning Session. The vision, mission and principles, along with suggested measures for success, are founded on an overall commitment to accessibility, collaboration and a focus on the learner. They apply to program content, processes and technological infrastructure.

The third section is an assessment of **The Current Situation**. It provides a brief overview of existing capability in three general areas: the current availability and use of technologies for learning on-campus and at a distance; some hardware and infrastructure already in place in Saskatchewan through SCN and SaskTel; and strategies and structures emerging in other Canadian jurisdictions. This section also touches briefly on planning currently underway within the universities and SIAST.

A fuller treatment of current practices and possibilities is provided in two Appendices. **Appendix A: Technologies for Learning** describes the technologies, with their strengths and limitations, and looks at various applications, some within Saskatchewan. It concludes with a description of a useful decision-making model developed by Tony Bates of the University of British Columbia. **Appendix B** provides an overview of **Innovation in the Post-Secondary Education and Training Sector**, while **Appendix C: Definition of Terms** includes terms commonly used in referring to technologies in learning.

Issues and challenges, with specific questions and some general ideas for addressing these, are explored in Section 4, **From Issues to Action**. These are based largely on what emerged at the Planning Session, followed by the Working Group's analysis of strengths, weaknesses, opportunities and threats in the Saskatchewan context. They are organized for convenience under the categories, *Learning Culture*, *Infrastructure and Delivery*, *Coordination*, and *Management*. An outline of potential **Roles and Responsibilities** of education and training partners is offered in **Appendix D** as an example of how action might be coordinated. The section also responds to the final request of participants at the Planning Session by recommending priority areas, along with mechanisms to complete the strategic plan and provide ongoing coordination and policy advice.

The discussion paper concludes with Section 5, **Feedback Requested**. This section poses questions on specific issues, challenges and recommendations explored in the paper and invites responses from education and training partners and stakeholders for further consideration.

Implications and Expectations

This discussion paper reflects a firm commitment by the province's key education and training partners to a system-wide policy framework for collaborative action to ensure effective and appropriate use of technologies for learning. By fulfilling the expectations of the first phase, as set out by participants at the May 1997 Planning Session, it prepares the way for the second phase. This would be to establish a representative coordinating body to complete the development of a strategic plan, articulating goals, objectives and an implementation plan suitable for all partners. In addition, the environmental scan offers a glimpse of some models and best practices that could inform the strategic thinking of such a body.

This paper is presented to the participants of the May 1997 Planning Session on technologies in learning. Delegates are encouraged to invite discussion among colleagues and constituencies and provide one ***coordinated*** response per organization.

List of Recommendations

The Working Group's key recommendations are identified as they occur throughout the paper. However, they are listed separately here for quick reference. Readers are referred to the appropriate sections for further information on the context and rationale.

1. That the Saskatchewan post-secondary education and training sector adopt the following as its **vision** statement for the use of technology to provide access to expanded and enriched learning opportunities for Saskatchewan people:

   Serving the learning and career needs of all provincial residents by using technology to ensure quality and accessibility, thereby enhancing intellectual, social and cultural well-being and enabling participation in the province's research activities, economic development and prosperity.

2. That the Saskatchewan post-secondary education and training sector adopt the following as its **mission** statement to reflect the means by which we strive to achieve the vision within a broader mission to provide high quality education and training for the people of Saskatchewan:

   To improve and enable learning through appropriate use of technologies.

3. That the Saskatchewan post-secondary education and training sector adopt the following as **principles** representing the values that underlie and guide individual and collective efforts to achieve the proposed vision. Accessibility and collaboration are implicit in all principles:

   Quality
   Investments in technological infrastructure, academic content, and instructional strategies should result in high quality products and services. Such investment is required in order to meet established standards and provide mobility for learners.

   Equity
   Developments should strive to ensure access to educational opportunities, regardless of the learner's place of residence or socio-economic circumstances. This principle is particularly important for the development of a technological infrastructure.

   Choice
   Actions should lead to more flexible, responsive, relevant and timely programs and services to meet individual and labour market needs. This will give both instructors and learners greater choice in content and delivery to accommodate different learning styles more effectively. Choice also means the appropriate technology to support multi-mode approaches.

Coherence
Developments should create a single, coherent, seamless, integrated infrastructure for the delivery of education and training in Saskatchewan. This means common software platforms and extensive collaboration to ensure compatibility, widespread access, and efficiency. Coherence also applies to academic content and administrative procedures. Coherent program standards, articulation, recognition and credit transfer can increase mobility and access.

Sustainability
A technology-enhanced learning environment should be sustainable in the long term. Sustainability requires a technologically sound infrastructure that can be maintained and supported by organizations within available resources. This also means a commitment to provide operational and program resources on an ongoing basis.

4. That the Saskatchewan post-secondary education and training sector judge its success in integrating technology in learning by the degree to which it achieves the following:
    - high quality, relevant learning opportunities, available in ways, places and times suited to the needs of the learner;
    - more flexible programs and choice of formats for access and delivery;
    - a common understanding of vision, mission, and strategic directions;
    - strong coordination among education and training institutions, the K-12 sector, network service providers, the provincial library, software and media specialists, community interest groups, and industry partners;
    - involvement of communities and employers in identifying needs and delivering programs;
    - investment in technologies to enhance learning for the long term;
    - institutions, learners and government contributing to a global learning culture;
    - a workforce skilled in using communications technologies to compete and thrive in a knowledge-based society; and
    - faculty adept at using a variety of technologies as instructional media.
5. That the Saskatchewan post-secondary education and training sector use the environmental scan completed as part of this discussion paper as essential background material for the completion of the strategic plan for enhancing learning through technology.
6. That the Saskatchewan post-secondary education and training sector use the description of issues affecting technology and learning completed as part of this discussion paper as essential background material for the completion of a strategic plan for enhancing learning through technology; and further that the sector give careful consideration to the strongly-held opinions expressed at the May Planning Session.

7. That the Saskatchewan post-secondary education and training sector consider the following key priority areas in developing a strategic plan for enhancing learning through technology (for details, see Section 4, **From Issues to Action**):
    1) Co-operation across the system to ensure the most efficient planning and operations
    2) Training to develop skills and experience in use of technology
    3) Infrastructure to support use of technology in learning
    4) Commitment to sustain the initiative
    5) Resources to support technology-enhanced learning
    6) Expanded role for SCN in enhancing a learning network
    7) Integration with the K-12 sector
    8) Global competitiveness

8. That the Saskatchewan post-secondary education and training sector create a "Partners' Council on Learning Technology," or some such body as outlined in **Recommendations for Coordinated Action**, to advise the post-secondary education and training sector on policy and strategic priorities, facilitate inter-agency collaboration and communication with stakeholders, and develop the province's collective expertise for enhancing learning through technology.

9. That until such time as the proposed Council develops its plan, existing mechanisms for the allocation of resources for program development and support continue to function.

10. That until such time as the proposed Council develops its plan, the current level of innovation and "championing" of initiatives be continued and that the Multimedia Program Development and Support Fund be restored to its original 1995 level.

11. That the Department of Post-Secondary Education and Skills Training take immediate steps to improve substantially the funding and staffing for its own very small unit responsible for technology-enhanced learning.

1 Introduction: Need for a Strategic Plan

Today's education and training community faces difficult issues regarding the incorporation of technology in learning. Policymakers warn that institutions adopt technology aggressively or risk being overtaken by institutions that are already doing so. Others believe that teaching and learning can be significantly improved, and/or costs reduced, through the use of technology. Still others suggest that only some institutions need to incorporate technologies fully, while others make only selective use.

There is some truth in all of these positions. For example, out-of-province institutions that have adopted new technologies more rapidly are already delivering programs into Saskatchewan. Technology, appropriately used, can improve and enable learning, and help to reduce overall expenditures. However, the issues regarding whether and when to use technology for learning are complex, and the forecasts should be viewed critically. At the same time, we cannot afford to ignore the issues and problems. Saskatchewan needs to position itself to take advantage of opportunities presented by technologies.

Saskatchewan's Multimedia Learning Strategy, *Connections to A World of Learning*, launched in May 1995, recognized these issues, challenges and opportunities. It emphasized new ways of teaching and learning in communities, in the workplace, and within traditional education and training institutions. That emphasis was reinforced more recently by the Department of Post-Secondary Education and Skills Training (PSEST) in the goals for university renewal articulated in *Public Interest & Revitalization of Saskatchewan's Universities*, in November 1996, and in *The Saskatchewan Training Strategy: Bridges to Employment*, in April 1997. Furthermore, increasing global advancements in technology require that we have a plan for addressing these issues.

In May 1997, Saskatchewan PSEST hosted a planning session to examine the current use of technologies in learning within the province's post-secondary education and training system, and the Training Strategy and University Revitalization initiatives. Representatives from the province's education and training institutions, Saskatchewan Education, other government departments and agencies, and interest groups discussed a new policy framework to guide the integration of technologies in post-secondary education and training for the province.

At the close of the Planning Session, participants called for action in three phases:

1. Form a working group to develop a discussion paper. This was to clarify a vision, mission and principles; assess the issues, opportunities and current state; articulate the strategic directions emerging from the planning session; clarify the respective roles of the partners and stakeholders; and recommend options for coordinated action to achieve the vision.
2. Establish a broader coordinating body representing stakeholders to develop a strategic plan, advise on provincial policy, and prepare an action plan to integrate technology in learning for the system.
3. Research existing capability within the post-secondary education and training system, best practices and models, and options for a pragmatic, co-operative approach to implementation.

This paper, representing the first phase, has been prepared by a working group upon the invitation of the Deputy Minister of PSEST. It suggests a vision, mission, and guiding principles for a technologically enhanced learning environment, identifies the challenges and issues facing institutions and learners in a world-wide context, and recommends options for a co-ordinated response to turn the challenges into opportunities. In addition, it provides a brief scan of current availability and use of technologies, as well as strategies emerging in other jurisdictions. Finally, the paper recommends a basic structure for a group that would assume responsibility for developing and implementing an action plan for the province.

2 Creating the Ideal Future

A global communications network and rapid advancements in technology are fundamentally changing the way we live, work, learn and play. New, interconnected technologies are becoming a part of everyday life, work and decision-making processes. People are now able to obtain and contribute to information on virtually every subject, anytime and anywhere. Skilled workers are in short supply. People are increasingly demanding high quality, relevant learning opportunities continually in their everyday lives. Choice and flexibility of programs are becoming critical to learner and teacher alike.

While form and meaning come from the discipline itself, technology can enhance and enable the learning experience. Its impact and its potential must be recognized and explored. The provincial government has emphasized greater use of technology to enhance program quality and effectiveness, to increase access to learning opportunities, and to prepare learners to live, work and prosper in a society based increasingly on the global development and sharing of knowledge.

Saskatchewan has a strong foundation for such a learning environment, with its advanced telecommunications network infrastructure, its high quality post-secondary education and training programs, and its long history of collaboration in use of technologies for learning. A common vision is needed to build on this infrastructure and ensure that it is sustainable and accessible to learners throughout the province. Similarly, co-operation to strengthen the province's collective expertise will be a key factor in the development of technology-enhanced programs and services to suit the needs of learners.

Some of the key questions to shape a new policy framework are:

- How do we frame public policy for a learning environment supported by technology?
- What is it we want to be? What is it we need to do?
- What is currently in place? What works? What needs to change?
- What key issues and opportunities can be addressed by a provincial policy framework?
- How do we ensure the right level of technology resources for effective teaching?
- Who are the partners and what is their role in achieving the vision?
- Where do we go from here?

The Working Group has outlined a **vision** statement, **mission** statement and **guiding principles** or values. These are proposed for further consideration to guide the management and use of technology for learning, with a focus on the needs of learners. They are framed within the broader mandate of the post-secondary education and training sector to provide high quality programs for the people of Saskatchewan.

2.1 Vision

Recommendation #1:
That the Saskatchewan post-secondary education and training sector adopt the following as its vision statement for the use of technology to provide access to expanded and enriched learning opportunities for Saskatchewan people:

> **Serving the learning and career needs of all provincial residents by using technology to ensure quality and accessibility, thereby enhancing intellectual, social and cultural well-being and enabling participation in the province's research activities, economic development and prosperity.**

2.2 Mission

Recommendation #2:
That the Saskatchewan post-secondary education and training sector adopt the following as its mission statement to reflect the means by which we strive to achieve the vision, within a broader mission to provide high quality education and training for the people of Saskatchewan:

> **To improve and enable learning through appropriate use of technologies.**

2.3 Guiding Principles

The values and public priorities underlying the University Renewal and Training Strategy initiatives, derived from extensive consultations with the province's education and training partners, provide the overall context for the use of technologies in learning. The principles below are considered key to successful integration of technologies in learning.

Recommendation #3:
That the Saskatchewan post-secondary education and training sector adopt the following as principles representing the values that underlie and guide individual and collective efforts to achieve the proposed vision. Accessibility and collaboration are implicit in all principles:

> **Quality**
> Investments in technological infrastructure, academic content, and instructional strategies should result in high quality products and services. Such investment is required in order to meet established standards and provide mobility for learners.
>
> **Equity**
> Developments should strive to ensure access to educational opportunities, regardless of the learner's place of residence or socio-economic circumstances. This principle is particularly important for the development of a technological infrastructure.

Choice
Actions should lead to more flexible, responsive, relevant and timely programs and services to meet individual and labour market needs. This will give both instructors and learners greater choice in content and delivery, to accommodate different learning styles more effectively. Choice also means the appropriate technology support multi-mode approaches.

Coherence
Developments should create a single, coherent, seamless, integrated infrastructure for the delivery of education and training in Saskatchewan. This means common software platforms and extensive collaboration to ensure compatibility, widespread access, and efficiency. Coherence also applies to academic content and administrative procedures. Coherent program standards, articulation, recognition and credit transfer can increase mobility and access.

Sustainability
A technology-enhanced learning environment should be sustainable in the long term. Sustainability requires a technologically sound infrastructure that can be maintained and supported by organizations within available resources. This also means a commitment to provide operational and program resources on an ongoing basis.

2.4 Achieving Success

How will we know when the vision is achieved? In order to move from vision to reality, the following specific outcomes are suggested to enhance learning with technology.

Recommendation #4:
That the Saskatchewan post-secondary education and training sector judge its success in integrating technology in learning by the degree to which it achieves the following:

- high quality, relevant learning opportunities, available in ways, places and times suited to the needs of the learner;
- more flexible programs and choice of formats for access and delivery;
- a common understanding of vision, mission, and strategic directions;
- strong coordination among education and training institutions, the K-12 sector, network service providers, the provincial library, software and media specialists, community interest groups, and industry partners;
- involvement of communities and employers in identifying needs and delivering programs;
- investment in technologies to enhance learning for the long term;
- institutions, residents, and government contributing to a global learning culture;
- a workforce skilled in using communications technologies to compete and thrive in a knowledge-based society; and
- faculty adept at using a variety of technologies as instructional media.

Success in achieving the vision will depend on the sector's ability to build on existing strengths and take advantage of opportunities, while overcoming obstacles.

3 The Current Situation

As a foundation for a strategic plan, it is important to understand what technologies are currently available and how these are being used for education and training. The following is a summary of the current situation in three areas: technologies; technological infrastructure in the province; and emerging strategies and structures in other jurisdictions. This sets a context for analyzing the issues and challenges facing Saskatchewan's post-secondary education and training system, and identifying priorities for action.

Recommendation #5:
That the Saskatchewan post-secondary education and training sector use the environmental scan completed as part of this discussion paper as essential background material for completing the strategic plan for enhancing learning through technology.

3.1 Current Use of Technologies for Learning

Technological change is significantly affecting post-secondary education and training, both in conventional face-to-face programs, and in institutions already using various technologies to reach learners at a distance.

In response to this challenge, institutions are developing a mixed-mode approach for both campus-based and distance learning settings. Options include televised or face-to-face off-campus instruction; independent study using print correspondence, telephone and local tutoring, audio and video cassettes, computer diskettes; and audio, video or computer conferencing. A multi-mode approach provides the flexibility to select the methods and formats most appropriate to the learning situation and the learning needs of a diverse population. Ultimately, this enhances the quality and effectiveness of the learning experience.

These elements — focus on the learner, flexibility, and commitment to quality and effectiveness — are key success factors for any program or learning institution. They have more to do with how instructors and learners use the resources available to achieve their learning objectives than with delivery methods.

Technologies in learning can also be used to increase interaction, and support new forms of communication. For example, the Internet World Wide Web can be used to host "channels" for computer-based conferences or small group discussions in real time, or to store information and assignments for learners to use at their convenience. "Virtual reality" technologies can be used to simulate real-life experiences and provide more opportunity for experimentation. With the appropriate technological infrastructure, it is already becoming possible to combine technologies and design programs effectively for either on-campus or alternate situations, or both at the same time.

Saskatchewan instructors are already exploring the potential of technology in a variety of ways. For example, the Multimedia Program Development and Support Fund introduced in 1995 has supported some 40 projects to develop technology-based courseware, learning resources and instructional strategies. These are outlined in **Appendix B: Innovation in the Post-Secondary Education and Training Sector**, along with similar initiatives linked to the Saskatchewan Training Strategy.

Each form of communications technology has distinct advantages and limitations for the learning process. Educators and trainers need to understand these in order to use technologies effectively.

Appendix A distinguishes between the various media, such as face-to-face, audio, video and text, and the technologies available to support these, such as telephone, satellite and computer systems. It examines the advantages and limitations of each, the potential for combining approaches as the technology and infrastructure are improved, and the costs and benefits, where possible. Following this primer on technologies are descriptions of various applications, illustrating the rich variety of technology-enhanced learning already evident, both in Saskatchewan, as indicated above, and elsewhere. A model for decision-making is then described. This outlines issues and circumstances to be considered in selecting the appropriate technologies, such as access, cost, pedagogical needs, level of interactivity, and ease of use.

Some definitions of terms pertaining to communications technology in the context of education and training are provided in **Appendix C**.

3.2 Saskatchewan's Technological Infrastructure

With its fibre optic network and its satellite television network, Saskatchewan has a strong foundation to support a provincial learning network. In addition, the province's education and training partners have already established a strong collaborative framework for technologies in learning through the Distance Education Program Review Committee (DEPRC). This committee advises the Deputy Minister on priorities for distance education course development and delivery.

3.2.1 Saskatchewan Communications Network — Supporting Learning Throughout the Province

The Saskatchewan Communications Network (SCN) has a provincial mandate to expand distance learning opportunities for the people of the province. SCN currently operates two interrelated satellite television networks. A training network supports televised delivery of some 50 post-secondary and high school classes annually to 174 classrooms in 143 communities, and is available to businesses and organizations for videoconferencing. A broadcast network provides curriculum support and cultural programming through cable systems, wireless cable and direct-to-home satellite, with the potential to reach all Saskatchewan residents.

Working with education and training partners, including the universities, SIAST, the regional colleges, Saskatchewan PSEST, and SaskTel, SCN has supported delivery of education and training programs in remote locations, including northern and Aboriginal communities, for nearly a decade. For many people in these communities, distance education is the only means of access to learning without leaving their homes, families, and jobs. Distance education allows people to acquire skills and ultimately contribute to the stability and economic survival of small communities.

SCN can play a key role in developing and managing a provincial network infrastructure to support a variety of modes and technologies for learning. In addition, SCN could support faculty both in training in the use of technologies and in the preparation of technology-based learning resources.

3.2.2 SaskTel: Internet Access, Audioconferencing and Videoconferencing

A glimpse at SaskTel's history illustrates the role that SaskTel can play in supporting the application of technologies in learning. In the 1940s to the 1960s, SaskTel converted small rural telephone systems into a province-wide system, ultimately to provide universal telephone coverage and service. This created the platform in Saskatchewan for what is regarded as one of the world's most advanced communications systems. SaskTel co-operates with SCN to provide teleconferencing and audioconferencing hook-ups to support delivery of programs at a distance.

Today, the Internet is newly defining telecommunications. Market research suggests a pent-up demand for Internet access in rural communities. SaskTel is supporting the development of local and wide area networks for online delivery of services such as the federal-provincial labour market information and career services networks. Recently, SaskTel introduced a high-speed Internet application known as the Asynchronous Digital Subscriber Line (ADSL) and is now in a position to provide Internet service in homes and communities.

3.2.3 Building on the Province's Existing Technological Infrastructure

The above overview and **Appendices A** and **B**, describing current practices and possibilities, illustrate how communications technologies can support a variety of approaches to learning. Saskatchewan already possesses the foundation infrastructure, the institutional commitment and the collective expertise necessary to take advantage of such opportunity. Optimal use of current and emerging technologies, however, will require investments in equipment, bandwidth and instructional development. These factors, along with previous experience, point out the need to strengthen and support collaboration in order to ensure effective development of a technology-enhanced learning environment. Significant planning is already underway.

One of the recommendations of the MacKay Report on University Revitalization, for example, was that the Department assess the readiness of the two universities for a future increasingly dependent upon communication technologies. In late 1997, each university prepared a "Baseline Study," characterizing their current state regarding the application of technologies to all areas of teaching, research and administration. Information on current technology infrastructure, support, relevant budgets and cultural issues was assembled for an external review team. Based on these documents and meetings with the two universities in November, the external reviewers prepared a report and recommendations for each university. These reports are being considered by both the Department and the universities for subsequent action.

Similarly, the potential of technology is being explored in various other applications to support education, training and labour market services. For example, as part of the Canada-Saskatchewan Strategic Initiatives, PSEST is developing community-based models for delivery of career and labour market information services using online multi-media technologies. These programs are supported by a provincial local area and wide area electronic network infrastructure being developed jointly by the two levels of government and SaskTel. In addition, a number of Work/Study and Job Start/Future Skills projects are testing the use of technology to support work-based training. These are described in an inventory of technology applications being compiled by PSEST as part of the Training Strategy. A modified version of this "work in progress" is included in **Appendix B**.

A joint effort is also required to ensure that rural communities have adequate access to the technology infrastructure for program delivery. Recently, the two universities announced a partnership with SaskTel to use videoconferencing technologies and the high-speed network between the two cities to deliver joint programs in highly specialized areas such as graduate engineering, education and computer science. Similarly, SaskTel has entered a partnership with SIAST to support a new Multimedia Communications program. SIAST is investigating the possibility of creating a "virtual campus," that will see the use of electronic communications to deliver programs and services to learners in Saskatchewan and beyond. Partnerships with SCN and SaskTel are being considered in these long range plans, to ensure extended access to smaller centres throughout the province.

3.3 Emerging Strategies and Structures in Other Jurisdictions

Strong system-wide collaborative approaches are being adopted across Canada and elsewhere to develop and implement strategies for the integration of technologies in learning. Almost all provinces have formed cooperative structures and established electronic networks to advance collective planning and action. The federal government is emphasizing partnerships in all initiatives to support the development of technology applications for the information highway. In the United States, a higher education consortium formed by the Western Governors to increase opportunities for distance learning is sweeping the region, with 19 universities now on board.

This section briefly outlines some organizational structures and practices in other jurisdictions that may inform decisions about what is most appropriate for the Saskatchewan context. Where available, Internet addresses are provided for further information.

3.3.1 British Columbia

A two-year policy development process has led to comprehensive strategic plan for the British Columbia post-secondary education and training sector. This plan focuses on collaboration in use of technology to increase quality, access and cost-effectiveness. Key initiatives include:

- A Policy Forum in 1995, followed by a Task Force to develop an action plan, *Access and Choice: The Future of Distributed Learning in B.C.* (May 1997), recommending:
    - coordinated provincial planning, with supporting structures in the Ministry of Education, Skills and Training and the institutions;
    - integration of technology in instruction, including training in use of technology;
    - institutional plans and policies to increase technology integration;
    - regional consortia to increase access.
- Centre for Curriculum, Transfer and Technology (C2T2) — formed by the Ministry as a catalyst to improve program access and effectiveness and transition to work;
- Standing Committee on Educational Technology (SCOET) — a representative body coordinated by C2T2 to advise on technology integration;
- Provincial Learning Network (PLNet), formed and managed by the Ministry, to oversee:
    - telecommunications services for educational, cultural, and economic development;
    - business alliances between government, the user community, and the private sector;
    - user support, communications with industry and the education sector, and regional advisory committees;
    - liaison between SCOET, C2T2 and PLNet to support the post-secondary education and training system.

Technology innovation in the university sector has a longer history through the Commonwealth of Learning, the Open Learning Agency, and distance learning centres at Simon Fraser University, University of Victoria and the University of British Columbia.

Further information is available at URL: **http://www.ctt.bc.ca/about.html**

3.3.2 Alberta

Alberta Advanced Education & Career Development has facilitated policy development for technology integration in several phases over the past three years, resulting in:

- A position paper, *New Directions for Adult Learning in Alberta* (October 1994), emphasizing use of technology and alternate delivery to increase learning opportunities;
- *Vision for Change: A Concept Paper for the Development of a Virtual Learning System* (September 1995) — a model for a virtual learning system;

- A provincial strategy, *Enhancing Alberta's Adult Learning System through Technology: Policy, Guidelines and Procedures for the Learning Enhancement Envelope* (June 1996), providing $30 million over three years for technology integration; principles and criteria for funding include:
  - accessibility, responsiveness, research excellence, affordability, and accountability;
  - system-wide development in a cooperative, transformational, and open manner;
  - long-term technology integration plans and performance measures;
  - curriculum adaptation; distance learning; training and research on integration of technology; learner support; and equipment.

Further information is available at URL: **http://www.aecd.gov.ab.ca/index.html**

3.3.3 Manitoba

In 1993, a Manitoba Task Force on Distance Education and Technology recommended community-based infrastructures for lifelong learning, requiring system-wide cooperation. Subsequent developments include:

- A digital network for interactive instructional television and high speed data transfer among high schools throughout rural Manitoba, and both on and off-campus post-secondary education, with satellite delivery into remote communities;
- MERLIN (Manitoba Education, Research, and Learning Information Network), an agency within Manitoba Education and Training to provide access to Internet, videoconferencing and teleconferencing, production facilities and satellite at low rates, along with consulting and training services;
- Advisory Council on Learning Technologies, representing various regional consortia, post-secondary institutions, education ministries and MERLIN;
- Learning Technologies Coordinator, to support and develop initiatives and the Council;
- Council on Post-Secondary Education to oversee funding, accreditation and program rationalization, and develop a business plan for collaborative distance education, including a cross-accredited first year university program and high priority community college programs throughout the province, including K-12 schools.

Further information is available at URL: **http://www.merlin.mb.ca**

3.3.4 Ontario

A recent report recommending strategic directions for Ontario's post-secondary education and training system, *Excellence, Accessibility, Responsibility* (December 1996), stresses collaboration among institutions and the private sector to acquire technology and adapt curriculum to enhance teaching, expand learning opportunities, and share resources.

Ontario's Open Learning Strategy also promotes collaboration in use of information technology to reduce costs, increase access and provide flexibility in program development, administration, and delivery. The Strategy supports the following:

- Contact North — a distance learning network that collaborates with the public and private sector to provide access to secondary, college, university and general interest programs for northern residents;
- Network for Ontario Distance Educators (NODE) — an electronic network to foster collaboration and coordination among universities and college faculty, administrators, learners and other practitioners in integrating communications technologies in teaching and learning, through such mechanisms as:
  - web-based conferences and forums on development and implementation issues;
  - provincial, national and international partnerships among private and public sectors;
  - professional development, projects and research on issues and practices;
  - newsletters and searchable databases on development and implementation issues.

Further information is available at URL: **http://www.cnorth.edu.on.ca/index.html** (Contact North) or **http://www.node.on.ca** (NODE).

3.3.5 New Brunswick

New Brunswick's 1993 strategic plan for a distance education network led to the creation of TeleEducation NB, to facilitate development of:

- Community learning centres or "electronic classrooms" to receive and deliver courses, in partnership with local communities, education institutions, and industry;
- A telecommunications infrastructure to support technology-based learning environments;
- A computer-based teleconferencing system, computer-aided communications, electronic data links and other multimedia technologies;
- Training and support for learners and teachers in use of technology;
- Distance delivery of university, colleges, and business courses and training programs, with local tutoring and support services.

In 1996, TeleEducation NB established TeleCampus, a "virtual campus" operating on the Internet/World Wide Web to provide:

- Access to education and training, both locally and around the world, through the province's public institutions, private trainers, information technology companies, government departments and non-profit organizations;
- A flexible environment for development and delivery of learning industry products.

TeleCampus is a key component of the Canada-New Brunswick Regional Economic Development Agreement to advance the training technology industry, support small companies, and provide equal development in the two official languages. A Programme Development Fund supports the development commercially viable training products and services for electronic delivery and export. Online programs include:

- Multimedia Computing and Bureautique (Office Technology), available at all N.B. community colleges (and Saskatchewan's francophone community);
- First year university by University of New Brunswick (UNB), with universities in Manitoba and B.C. (may soon include a University of Saskatchewan Political Studies course developed under PSEST's Multimedia Program Development and Support Fund);
- A B.Ed. upgrading program for export to Trinidad and possibly other foreign markets;
- A consortium of K-12 schools, with Newfoundland, British Columbia and Alberta, to develop Information Technology course materials, also be used for teacher training.

TeleEducation NB is cooperating with the province's community access network and Service NB, an agency providing online government services.

Further information is available at URL: **http://teleeducation.nb.ca**

3.3.6 Canada

The federal government, through the Departments of Industry and Human Resources Development, provides funding to support technology development and applications, primarily to help rural communities to connect to electronic information networks and take advantage of emerging education, social and economic development opportunities. Initiatives include:

- **Information Highway Advisory Council:** to advise on development of the nation's networking capability;
- **SchoolNet:** to connect students through the Internet and develop skills in using electronic tools for learning — expected to link all Canadian schools, libraries, colleges and universities by the end of 1998;
- **Community Access Program (CAP):** partnerships among rural schools, regional colleges, libraries, regional economic development authorities, municipalities, business, community network associations, and other organizations to provide affordable public access to the Internet, and training and support for users — approximately 100 sites connected to date and a total of 250 planned by 2000;
- **Canadian Network for the Advancement of Research, Industry, and Education (CANARIE):** to develop Canada's communications infrastructure through such programs as the Technology and Applications Development fund for development and commercialization of networking technologies and applications, especially broadband multimedia networking application and product development, health and education networking, and advanced research and distance learning applications;
- **Office of Learning Technologies (OLT):** to expand opportunities for adults to develop knowledge and skills for a knowledge-based economy through:
    - effective use, assessment, research, and testing of learning technologies;
    - development and sharing of knowledge about learning technologies;
    - monitoring of trends, issues and challenges in use of technologies for learning;

  - strategic alliances to promote dialogue on effective use of technologies, including a multi-disciplinary network of experts from the academic community, private and public sectors and non-government organizations to advise on issues;
  - sponsor projects related to distance and technology-enhanced learning.
- **Strategic Initiatives** such as the online Labour Market Information and Career Services networks, as part of the Canada-Saskatchewan Labour Market Agreement, to support learners, trainees and job seekers in urban, rural, and northern Saskatchewan.

Further information is available at URL: **http://www.schoolnet.ca** (SchoolNet); **http://cap.unb.ca** (Community Access Program); **http://www.canarie.ca** (CANARIE); and **http://www.olt-bta.hrdc-drhc.gc.ca** (Office of Learning Technologies).

3.3.7 United States of America: Western Governors University

The Western Governors University (WGU) is a market-oriented, degree-granting "virtual" university. It was formed in 1997 by a consortium of western United States governors to expand higher education and training opportunities in various setting, including the workplace. Focussed on needs of learners and employers, and regional sharing of resources, WGU aims to provide high quality, cost-effective programs, using the Internet, CD-ROMs, satellite television, videotapes and other advanced telecommunications and networking technologies.

Program standards will be developed by faculty and industry experts. Student competency, knowledge and skills will be the measures of success, rather than credit hours or institutional credentials. Beginning delivery early in 1998, WGU will ultimately raise full budget revenue from private, non-profit sources.

Currently, 19 states are participating, and WGU has begun to collaborate with international partners Great Britain; British Columbia, Japan; and Mexico. A Memorandum of Agreement with Universities in these locations specifies cooperation to:

- promote international education and understanding of international delivery issues;
- remove national barriers to the exchange of courses, programs and awards;
- explore opportunities to collaborate through joint ventures and consortia;
- encourage other institutions to join this effort.

Korea, Israel, Scotland, Russia, China, and Malaysia have also expressed interest.

In addition, WGU is seeking partnerships with non-traditional education and training providers. Major corporate partners include IBM, Sun Microsystems, Micron, AT&T, US West, International Thomson Publishing, Simon & Schuster, Novell, KPMG, 3Com, Apple Computer, Matrixx Marketing, and Microsoft.

Further information is available at URL: **http://www.westgov.org/smart/vu/vu.html**

4 From Issues to Action

Many issues were identified and discussed at the Technologies in Learning Planning Session in May 1997. Further exploration and clarification of these issues revealed a number of challenges facing the post-secondary education and training system in using technologies. These are identified immediately following the discussion of issues, along with a list of key priorities for coordinated action.

4.1 Clarification of Issues

For convenience, the issues are grouped in four categories, as outlined in the table below, and presented in question and answer format. This section is intended to stimulate further discussion and questions. This will help to prepare the groundwork for further development of a province-wide strategic plan to incorporate information technologies in post-secondary education and training.

Learning Culture	Infrastructure and Delivery	Coordination	Management
• trends	• learning needs and content	• policies	• participants and roles
• equity and access	• networks	• resources	• functions and structures
• learner role, training, and support	• design, development, and delivery		
• instructor role, training, and support	• hardware, software and infrastructure		

It is important to note that many strongly-held opinions were expressed at the May Planning Session that may not be captured fully in the analysis provided here. In particular, strong opinions were expressed concerning the following:

- the difficulty of determining demand for courses delivered by new media when learners might not yet have access to the selected technology;
- the potential for further marginalizing those who already face disadvantages in society;

- avoiding the danger of having decisions driven by technology rather than by learning needs and ensuring that technology serves learning;
- support for learners; and
- support and reward systems for instructors.

Some of these issues, such as the ones related to policy, have been addressed elsewhere in the discussion paper. Others, while not specifically addressed, may be considered implicit.

4.1.1 Learning Culture

Trends

1. Is there a demand for expansion of TEL in Saskatchewan?

   Current enrolment levels are not strong for either televised or Internet-based courses in the province. Few courses of either type are presently available. Courses currently offered by television may have reached a saturation point, while the system is not yet ready for Internet-based courses. In addition, a segmented learner market is emerging, ranging from recent high school graduates interested in first and second year general university courses or two-year technical diploma programs, to employees needing apprenticeship training in their home communities or professional upgrading in highly specialized areas.

   Some cause and effect dilemmas are also apparent: Is demand low because relatively little content exists? Would more content generate greater demand? Is faculty reluctant to adopt technology?

   Anecdotal evidence suggests that technology-enhanced courses originating from out-of-province, such as University of Waterloo and Athabasca University, are increasing in popularity among Saskatchewan residents. Does this suggest sufficient interest in TEL? Is it too early to make long-term forecasts? Should Saskatchewan necessarily follow the trend to use technologies for learning?

2. In the information age must the role of the institution change?

   Institutions no longer have a monopoly on the supply of information. They need to emphasize key functions such as shaping of raw information; development of creative and critical thinkers; construction of knowledge; and validation of competence (for example, through issuing credentials).

3. What general trends could affect the way TEL evolves in the province?

   Some obvious trends are:

   - Today's students, like consumers, now demand a more differentiated selection of goods and services. They are accustomed to being "marketed" by industry.
   - Increasingly, electronic media are being integrated into everyday life.
   - There is persistent societal pressure for greater productivity and higher quality service from the public sector.

- We are witnessing the globalization of education: aggressive public institutions and private companies are actively producing educational material for a world marketplace.

Equity and Access

1. To what extent can TEL increase access to learning opportunities?

   Increased access is directly related to increased resources provided for TEL. Some suggest that reallocation of existing funds could result in no net increase in accessibility if those funds were redirected from traditional instruction. On the other hand, technologies may help to increase effectiveness and efficiency of existing programs and services.

2. Will expansion of TEL enable those currently excluded to participate or further marginalize them?

   Those who do not have access to technology or do not acquire the skills to use it may be marginalized. Some fear the emergence of a two-tiered education system unless tools are equitably distributed.

3. For what special groups can TEL increase access to learning opportunities?

   Groups who could benefit are people in rural, northern, and Aboriginal communities; people with physical or learning disabilities; people facing home, work, or family obligations; and single parents.

Learner Role, Training, and Support

1. What skills and attitudes do learners require to benefit from TEL?

   Critical thinking and research skills are required to gather, organize, and assess information. Computer literacy is a basic requirement, but computer fluency is a desirable goal. As well, students need to be willing to interact with their material, other learners, and their instructors. If students are passive or merely reactive, they will not benefit from TEL.

2. Are present levels, types, and methods of learner support adequate for TEL?

   Substantial information about employment, careers, and programs of study is available in conventional and electronic formats.

   Learner support is considered adequate at the larger urban institutions, but some institutional services, such as counselling, are limited for off-campus students. The regional colleges provide counselling, testing, tutoring, and administrative services for rural and northern students.

   Certain services could be provided on a province-wide basis, such as online library services, training in the use of technologies, and a help line for technical support.

3. Can the social dimension of learning be accommodated by TEL?

   A critical mass of users would be required to create a social dimension. Opportunity for social interaction varies with the medium.

   A virtual forum for informal student interaction, a "virtual cafe" for example, is an idea worth consideration. Social support for independent learners might also be found outside the course or the host institution, such as in the local library or workplace.

Instructor Role, Training, and Support

1. What factors presently discourage instructors from developing TEL approaches?

   It can take some time and specific training for instructors to understand and exploit the potential of TEL. The faculty reward system, especially at universities, does not place high value on instructional strategies. TEL is often considered to be either a peripheral activity or an eccentric practice outside mainstream academic culture.

2. What factors could encourage greater involvement by instructors in TEL?

   Technology that is readily available, reliable, flexible, and easy to use is considered essential so as not to interfere with the core business of teaching and learning.

   The cultivation of strong "champions" for TEL within the education and training system would, over time, form the critical mass needed to effect cultural change within the profession.

   Learning centres could provide instructional design and technical support, and regular training sessions or symposia on related subjects. This implies additional personnel in the areas of instructional design and technical support.

   A strong reward or compensation system would encourage integration of TEL.

3. How does TEL affect the role of the instructor?

   The instructor's role changes from dispensing knowledge to managing learning.
   The instructor must devote more attention to instructional strategies, not just content.
   TEL may require a team approach to design, production, and delivery.

4.1.2 Infrastructure and Delivery

Learning Needs and Content

1. What special characteristics of the Saskatchewan learning population need to be considered?

   There is a strong desire to ensure sensitivity to Aboriginal culture, language, and education and training needs.

2. What are the learning needs for which TEL solutions are most appropriate?

   It has been suggested that technology could and should be integrated into all facets of the learning process. This implies that all instructional programs adopt technology.

However, some stress that technology is merely a tool, and that the learning context should dictate its application. A better mechanism is required for identifying diverse needs and delivery formats. Research on "best practices" would inform discussion on these issues.

3. To what extent should Saskatchewan develop its own TEL programs when courses can be purchased in the global educational marketplace?

   Saskatchewan should focus and build on areas of uniqueness and expertise. A "centre of excellence" approach was proposed. There is some fear that Saskatchewan will fall behind, or become dependent on external suppliers unless the province supports local product development.

Networks

1. What does the term "network" mean? What should be its characteristics?

   The term "network" is commonly used in a variety of ways, including:

   - telecommunications infrastructure
   - Internet
   - local area network
   - wide area network
   - relationships between people
   - relationships between institutions
   - education data network
   - as a synonym for "system"
   - confused with technical applications
   - "distributed network," a decentralized computer-based system with a number of control hubs or nodes.

   Essentially, a "network" can be human, institutional, or electronic. Electronic networks can be based on differing technologies. The notion of a network suggests coherence: seamlessness, integration, and articulation (see **Appendix C: Definition of Terms**).

2. At what state of development is a provincial learning network?

   A province-wide, ubiquitous telecommunications network needs to be developed. It was noted, for example, that only one third of the Province's libraries are presently connected to the Internet. Libraries would be considered an essential component of any network to support delivery of academic programs. Furthermore, there is a need to determine the types of carriage that will define a "learning network," such as audio, video, and/or data. A learning network could be built on existing structures, such as the fibre optic cable and satellite television networks, supported by regional colleges and Community Access Program sites.

Design, Development, and Delivery

1. What is our present level of understanding regarding the principles and practices of instructional design in TEL?

The field is quite new: more research and experimentation are required. There are relatively few practitioners in Saskatchewan. Human resource development is required.

2. Given such a wide array and continuous evolution, how should program providers go about choosing technologies?

   Suggested selection criteria include:

   - content type
   - learner characteristics
   - pedagogical strategies
   - infrastructure capacity (wiring/cabling, hardware/software, technical support, etc.)
   - development, production, and distribution costs
   - revenue potential
   - administrative considerations.

3. Can the various media be compared in terms of developmental cost or cost-effectiveness?

   Determining cost-effectiveness is difficult. There are many offsets. For example, upfront development costs can be offset by large-scale delivery over time. It is not a given that TEL approaches are cheaper solutions.

4. What are key indicators of an education system that has successfully incorporated TEL?

   Delivery and service are credible, reliable, flexible, and responsive. Users would have ready access to technical support services like 24-hour, toll-free trouble lines. TEL resources should be user-friendly, permit some choice, and be of sufficient quality to compete in a world market.

   There would be strong coordination between the key institutional partners. Communities and employers would be involved in identifying needs and supporting learners.

   Other indicators would include greater use of TEL by instructors and learners, more productive teaching and learning, and a proliferation of increased TEL products and services.

Hardware, Software, and Infrastructure

1. At what state of development is the province's infrastructure?

   SaskTel and the cable companies continue to upgrade the backbone of the telecommunications system. Fibre optic lines or microwaves link five cities, three schools, Palliser and Woodland campuses, and the universities.

   Not all public education facilities are equipped to provide access to the Internet. Some facilities are leased, not owned, which may present difficulties. In the past, Departmental policy has excluded technology infrastructure costs from capital or facility funding.

   In addition to its public broadcasting network, the Saskatchewan Communications Network (SCN) operates a closed-circuit training network. This network consists of a number of originating sites which transmit television signals via satellite to signal receiving sites situated throughout the province, many operated by regional colleges. Most residents in the south live within 50 kilometers of a receiving site. The situation in the north is not comparable, but access is reasonable in population centers.

It was suggested that SCN sites be upgraded to support delivery using a variety of media and technologies. The bandwidth required to support video via terrestrial lines is not presently available at receiving sites, although this situation is changing.

2. To what extent is the hardware of TEL accessible?

   Generally speaking, telephone, radio, cable television, video-cassette recorders, fax machines, and tape players are available at home or close to home. These, however, are not available in isolated settlements or in some Indian reserves. Analog receiving dishes are common in rural Saskatchewan, and digital receiving dishes are increasing in popularity. Most K-12 schools have computers, but in many cases these are inadequate for contemporary applications. Modern computers and peripherals are increasingly common in middle class homes. Internet access is possible, although not yet widespread.

4.1.3 Coordination

Policies

1. To what degree should technology drive future development of our education system?

   Learning needs, not particular technological applications, should drive the system. However, technological innovation has always exerted influence and will continue to do so. Enthusiasm for technological solutions ought to be tempered by critical reflection.

   For the apprentice trades, the standards of industry, more than the needs of learners or technology, are considered the key driver of future development of the training system.

2. What other governmental plans or policies could have an impact upon, be influenced by, or be linked to TEL?

   Many governmental plans or policies were identified, as follows:

   Within PSEST, the key initiatives are:

   - Multimedia Learning Strategy
   - Saskatchewan Training Strategy
   - University Renewal
   - the Saskatchewan Communication Network's (SCN) plans for videoconferencing
   - SIAST plans for a virtual campus

   Initiatives outside PSEST include:

   - Saskatchewan Education
     - Multimedia Learning Strategy/Evergreen Curriculum
   - Economic and Co-operative Development — promotion of the information technology and new media industries, as evidenced in:

    - Partnership for Growth
    - Enabling Prosperity
    - proposed Regina R&D park/Innovation Place in Saskatoon
- SaskTel
    - SaskConnect proposal
    - Advanced Interactive Solutions strategy
- Federal Government
    - Community Access Program
    - SchoolNet
    - Office of Learning Technologies
    - Networks of Centres of Excellence in Telelearning
    - Information Highway Advisory Council
- other jurisdictions (see **Emerging Strategies and Structures in Other Jurisdictions**)

3. What priority does TEL have compared to other government initiatives?

   Strong, consistent political and financial commitment to TEL is critical to its success. Government spending in this area needs to be seen as a strategic investment, the object of which is to improve the intellectual, social, and economic well-being of the province through greater application of technology.

4. Should TEL aggressively promote the use of any particular medium or technology?

   Choice and flexibility are essential for learners, instructors, and developers. There is strong support for a multi-mode approach to TEL. Certain efficiencies and administrative benefits may result from using one technology exclusively. However, it is difficult to predict whether any particular technology will become obsolete and superseded over time. As well, focussing on one particular technology to the exclusion of others is not sound instructional policy. Critical reflection is required to inform decisions on the integration of new technologies. For example, appropriate use rather than novelty or prowess should govern choices.

Resources

1. What resources are required for TEL? Who is responsible for providing these?

   There was general consensus that all parties need to review the resources needed to support TEL and determine what they are prepared to commit, based on institutional and provincial strategic priorities. This would better enable them to secure funding from other sources and determine how existing resources could be deployed.

   Considerable human, material, and financial resources will be required for the further development of TEL in the province. There is a need to:

   - determine how existing resources might be redeployed to support TEL
   - determine what additional resources are required to advance TEL

- secure strong financial support for all aspects of TEL, including courseware, operations, and infrastructure
- determine how to estimate appropriate costs and fund these as part of normal operations.

4.1.4 Management

Participants and Their Respective Roles

1. Who are the "partners" in TEL? Who will be actively involved in TEL development and held accountable for results?

   A number of organizations or groups are considered to be the key partners, while others may have some role or interest. These include:

   - PSEST, including the Provincial Apprenticeship Board
   - administrators of the province's post-secondary education and training institutions, including the universities and SIAST, all affiliated and federated colleges, regional colleges, and Aboriginal institutions
   - faculty and instructional designers
   - Saskatchewan Communications Network
   - Saskatchewan Education, including the correspondence school
   - K-12 School Divisions
   - Saskatchewan Economic and Co-operative Development, including agencies like the Saskatchewan Opportunities Corporation, Saskatchewan Trade and Export Partnership, Saskatchewan Research Council, and the Regional Economic Development Authorities
   - SaskTel
   - Provincial Library and regional libraries
   - private sector trainers
   - information technology, telecommunications, new media, and software development industries
   - Federal government, including Human Resouces Development Canada, Office of Learning Technologies, and Industry Canada *et al.*

2. In what areas are the partners best able to contribute to TEL development? That is, what are their expected roles?

   This area requires extensive consideration. The following is presented to stimulate discussion:

   - CEO level commitment is considered critical to the success of TEL.
   - Partners must be prepared to function in a co-operative, rather than a competitive mode, and respond to the stakeholders' needs and concerns.
   - Smaller partners ought not to be considered junior partners, even though they may not play an active a role in design, development, and delivery.

Collaboration may require a differentiation of partner roles and specialization. Partners would be expected to play advisory, executive, and/or supportive roles in the following areas:

- policy (plans, priorities, strategies)
- products (content, design, production)
- pedagogy (instructor and learner)
- promotion (sales/communication)
- infrastructure (wires and boxes)
- network (a "Learning Network")
- human resources (personnel, expertise)
- material resources (equipment, facilities)
- financial resources (grants, loans, investments)
- access (rural and northern access).

3. Who are the "stakeholders" in the TEL?

   Generally speaking, stakeholders are those parties with an interest in the outcomes of TEL, but who are not expected to make a material contribution TEL design, development, or execution. There are many stakeholders, including:

   - students
   - employers
   - employees
   - special interest groups, such as the Labour Force Development Board, and proposed regional education partnerships
   - ethnocultural groups.

4. In what areas can stakeholders best contribute TEL? That is, what are their expected roles?

   Stakeholder roles would include:

   - issues and needs identification
   - financial and in-kind support
   - feedback and evaluation.

   An outline of potential key partners, relationships, roles and responsibilities is provided in **Appendix D** for consideration.

Functions and Structures

1. What functions are required for effective governance and management of an initiative as complex and dynamic as TEL? What sort of leadership style is appropriate for this initiative?

   A collective, yet highly differentiated effort is envisioned. Leadership functions include:

   - creating a new culture;
   - assembling institutions, learners, and industry for common objectives;
   - planning and setting priorities;
   - supporting the development of products; and
   - providing communication channels.

Administration should not result in over-regulation or micro-management, nor impede the creative work of practitioners.

2. What structure(s) are required to carry out these functions?

   A system-wide, collaborative, coordinated approach is suggested with a general coordinating body to exercise leadership functions. Although there is support for central leadership, at the same time there is a strong endorsement of decentralized, differential execution of TEL.

   A telecommunications network to support multi-mode approach is considered essential.

4.2 Challenges

The above description of issues reveals a number of challenges faced by the province and the education and training institutions in integrating technologies for learning. These need to be explored and further articulated as part of the strategic planning process, and should form the foundation for coordinated action. An outline is provided below.

4.2.1 Learning Culture

Institutions have identified a strong need to:

- develop popular and professional attitudes and practices which will enable intelligent and effective uses of technology for teaching and learning; and
- secure strong commitment for TEL from the partners and stakeholders.

4.2.2 Infrastructure and Delivery

Individual and collective action are required to:

- identify high priority course development needs and to rank course development projects for funding purposes;
- select the correct medium and learning technology for any given TEL project; and
- define, design, and build a learning network.

4.2.3 Policy Coordination

System-wide coordination is needed to:

- secure broad government and institutional support for TEL at the policy level;
- align TEL with other PSEST and institutional policies and initiatives;
- align TEL with the policies and initiatives of other Departments and agencies; and
- secure appropriate human, financial and material resources.

4.2.4 Management

Some in-depth analysis and articulation are required to:

- determine a management style, processes, and structures that will be effective for an initiative as complex and dynamic as TEL; and
- clarify the expected roles and responsibilities of the partners and stakeholders.

The above description of issues and challenges, while perhaps not capturing the full complexity and dynamic nature of the activity, should help to inform decision-making and policy development for technologies in learning.

Recommendation #6:
That the Saskatchewan post-secondary education and training sector use the description of issues affecting technology and learning completed as part of this discussion paper as essential background material for the completion of a strategic plan for enhancing learning through the use of technology; and further that the sector give careful consideration to the strongly-held opinions expressed at the May Planning Session.

4.3 Key Priorities and Recommendations for Coordinated Action

4.3.1 Priorities

In order to identify the province's potential for enhancing learning through technology and moving beyond the issues to action, the Working Group analyzed the post-secondary education and training system's strengths and weaknesses in its use of technology for learning. The group then considered barriers to and opportunities for further development. This discussion led to a statement of key priorities for action, identified below.

This list of priorities is arranged in a sequence that reflects action required to advance TEL effectively. A table showing how these might be grouped in the categories used for the issues and challenges above is added at the end of the section.

Recommendation #7:
That the Saskatchewan post-secondary education and training sector consider the following key priority areas in developing a strategic plan for enhancing learning through technology:

1) Co-operation across the system to ensure the most efficient planning and operations
   - That the key partners make a firm commitment to:
     - bring resources to the table to ensure a collaborative effort;
     - maintain a healthy internal technology infrastructure; and
     - develop a system plan to acquire and allocate resources.
2) Training to develop skills and experience in use of technology
   - That the stakeholders and partners conduct an inventory and develop a database of their training needs and assets, share their existing skills and experiences, and make their inventory and databases available to all.
3) Infrastructure to support use of technology in learning
   - That the partners contract outside expertise to conduct an infrastructure gap analysis and make recommendations for action by March 31, 1998. (It was noted that the universities are doing this through their baseline technology study as part of the university revitalization process. SIAST is also reviewing its technological capacity in conjunction with plans to develop a "virtual" campus); and
   - That the partners and executive government acquire resources and make a commitment to act on those recommendations by June 30, 1998. (It was noted that this would have to be integrated into regular budget cycles.)
4) Commitment to sustain the initiative
   - That the partners create a comprehensive plan to achieve the vision, and that this plan be aligned with other government strategies and priorities; and
   - That stakeholders and partners garner support from their communities to endorse the plan, as indicated in the first priority, and recommend it to executive government.
5) Resources to sustain the initiative
   - That the partners use existing resources more effectively to lever other funding from such sources as PSEST, Saskatchewan Education, the federal government, the private sector, other provinces, and international projects; and
   - That long-term funding be allocated to ensure development and implementation of appropriate strategies for technologies in learning.
6) Expanded role for SCN in enhancing a learning network
   - That the role of SCN be expanded to provide province-wide support for and access to all media-enhanced learning, similar to the support it now provides for televised instruction. Contemplated are such mechanisms as an audioconference bridge, computer networks and a helpline. As well, it is important that SCN further develop its expertise as a broker to manage a multi-mode system infrastructure; and
   - That SCN's excellent educational network support and service be acknowledged as a foundation on which to build the broader network.

7) Integration with the K-12 sector

- That planning for the post-secondary education and training system be integrated with planning for the K-12 sector in areas such as facilities, network infrastructure and connections, equipment, programs, and training for instructors.

8) Global competitiveness

- That Saskatchewan's post-secondary education and training system become internationally competitive, specifically to:
  - collaborate with other provinces in broad areas where subject matter is common, such as in arts and science, in order to gain economies of scale;
  - focus energy, resources and efforts on areas of strength and uniqueness that are marketable both at home and abroad — and use revenue generated from this activity to develop less marketable, but essential programs;
  - focus international efforts on Internet-based instruction, where appropriate; and
  - co-operate in international marketing to generate opportunities and reduce costs.

4.3.2 Recommendations for Coordinated Action

The Working Group was specifically asked to recommend a structure that could carry out further development of a strategic plan and to provide ongoing advice and coordination for the integration of technologies in learning. Based on their review of the issues and priorities, and strategies and structures emerging in other Canadian jurisdictions, the group proposes that a coordinating body be formed to advance the provincial TEL initiative. Reflecting a system-wide collaborative approach, it is suggested that such a body be called the "Partners' Council on Learning Technology" and be assigned the following functions:

- advise the post-secondary education and training sector on policy and strategic priorities for TEL — a similar function to that proposed for the Multimedia Learning Strategy of 1995;
- provide a vehicle for inter-agency communication; and
- provide a forum to receive input and feedback from TEL stakeholders.

The proposed composition of the coordinating body would be:

- Representation from organizations considered to be "partners" in TEL. Individuals would be appointed based on their expertise in higher education, technology and public policy. Appointees should have authority to speak on behalf of their respective organization and commit resources to TEL.
- The membership base should be broader than that of existing structures such as DEPRC.
- The Council should be chaired by a high ranking PSEST official.
- Membership should be drawn from each of the following sectors:
  - PSEST and its partner institutions and agencies;

    - external provincial and federal Departments and/or agencies; and
    - the private sector — specifically information technology and telecommunications, new media, and private training industries.
- Various standing committees could be established, such as a program review committee, a technical committee, and an instructional strategies committee.

The following tasks are identified for the proposed coordinating body:

- consider the recommendations put forward in this paper;
- review responses to the discussion questions posed in the feedback section;
- propose additional recommendations;
- identify best practices and models, starting with the research materials assembled to date;
- develop internal operating procedures and committee structures;
- develop an action plan, including recommendations for:
    - other structures required for TEL, such as a Department unit and a learning network,
    - roles and responsibilities of the partners,
    - short and long term objectives for TEL, and
    - resources required to realize the plan.

Recommendation #8:
That the Saskatchewan post-secondary education and training sector create a "Partners' Council on Learning Technology" or some such body as outlined in **Recommendations for Coordinated Action**, to advise the post-secondary education and training sector on policy and strategic priorities, facilitate inter-agency collaboration and communication with stakeholders, and develop the province's collective expertise for enhancing learning through technology.

Recommendation #9:
That until such time as the proposed Council develops its plan, existing mechanisms for the allocation of resources for program development and support continue to function.

Recommendation #10:
That until such time as the proposed Council develops its plan, innovation and "championing" of initiatives be continued and that the Multimedia Program Development and Support Fund be restored to its original 1995 level.

In addition, the Working Group noted that the Department's own unit responsible for technology-enhanced learning is woefully under-staffed and under-resourced and that immediate steps need to be taken to rectify this situation if any meaningful work on a strategy is going to be achieved. This needs to happen *before* any proposed new coordinating body is created, in order to provide the support structure required by the new body to perform its functions.
Therefore, the group makes the following:

Recommendation #11:
That the Department of Post-Secondary Education and Skills Training take immediate steps to improve substantially the funding and staffing for its own very small unit responsible for technology-enhanced learning.

4.3.3 Linking Key Priorities and Recommendations with Issues and Challenges

For easy reference the recommendations and key priorities identified throughout the text are arranged below in the categories used for the issues and challenges.

Learning Culture

Key Priorities	Recommendations
That Saskatchewan's **institutions** make a firm commitment to bring resources to the table to ensure a collaborative effort; maintain a healthy internal technology infrastructure; and develop a system plan to acquire and allocate resources.	That Saskatchewan's **institutions** conduct an inventory and develop a database of their training needs and assets, share their existing skills and experiences, and make their inventory and databases available to all.
That Saskatchewan's **institutions** focus their energy and resources on areas of strength and uniqueness that are marketable both at home and abroad — and use revenue generated from this activity to develop less marketable, but essential programs.	That Saskatchewan's **institutions** collaborate with institutions in other provinces in broad areas where subject matter is common, such as in arts and science, in order to gain economies of scale.
That Saskatchewan's **institutions** focus international efforts on Internet-based instruction, where appropriate.	That Saskatchewan's **institutions** co-operate in international marketing to generate opportunities and reduce costs.

Infrastructure and Delivery

Key Priorities	Recommendations
That the role of SCN be expanded by **PSEST** to provide province-wide support for and access to all media-enhanced learning, similar to the support it now provides for televised instruction. (Contemplated are such mechanisms as an audioconference bridge, computer networks and a help line. As well, it is important that SCN further develop its expertise as a broker to manage a multi-mode system infrastructure.)	That Saskatchewan's **institutions** contract outside expertise to conduct an infrastructure gap analysis and make recommendations for action by March 31, 1998. (It was noted that related initiatives are underway at SIAST and the universities.)
	That Saskatchewan's **institutions** and **PSEST** acquire resources and make a commitment to act on those recommendations by June 30, 1998. (It was noted that this would have to be part of the regular budget cycle.)

Coordination

Key Priorities	Recommendations
That the **sector** endorse the vision, mission, principles, and success indicators articulated in the discussion paper.	That the **sector** create a comprehensive plan to achieve the vision, and that this plan be aligned with other government strategies and priorities.

Key Priorities	Recommendations
That Saskatchewan's **institutions** garner support from their communities to endorse the plan, as indicated in the first priority, and recommend it to executive government.	That the **sector** create a "Partners' Council on Learning Technology" to: develop a strategic plan; advise on policy; facilitate inter-agency collaboration and communication with stakeholders; develop the province's collective expertise for enhancing learning through technology; and to use the scan of other jurisdictions and descriptions of issues and essential building material to complete the strategic plan.
That Saskatchewan's **institutions** use existing resources more effectively to lever other funding from such sources as PSEST, Saskatchewan Education, the federal government, the private sector, other provinces, and international projects.	That Saskatchewan's **institutions** and **PSEST** allocate long-term funding to ensure development and implementation of appropriate strategies for technologies in learning.
That planning for the post-secondary education and training **sector** be integrated with planning for the K-12 sector in areas such as facilities, network infrastructure and connections, equipment, programs, and training for instructors.	That the **sector** use the environmental scan and description of issues affecting technology and learning completed as part of this discussion paper as essential background for completion of a strategic plan for enhancing learning through technology.

Management

Key Priorities	Recommendations
That until such time as the proposed Council develops its plan, **PSEST**'s existing mechanisms for the allocation of resources for program development and support continue to function.	That until such time as the proposed Council develops its plan, innovation and "championing" of initiatives be continued and that **PSEST**'s Multimedia Program Development and Support Fund be restored to its original 1995 level.
That **PSEST** take immediate steps to improve substantially the funding and staffing for its own very small unit responsible for technology-enhanced learning.	That **PSEST**'s proposed Council develop an action plan, including recommendations for: • other structures required for TEL, such as a Department unit and a learning network; • roles and responsibilities of the partners; and • short and long term objectives for TEL, and resources required to realize the plan.

5 Feedback Requested

5.1 What is the Viewpoint of the Education and Training Partners and Stakeholders?

Saskatchewan's post-secondary education and training system is formulating a new policy framework for the use of communications technology to enhance, support and expand learning opportunities. In May 1997, Saskatchewan PSEST hosted a planning session with education and training partners to explore the issues and challenges in creating such an environment. On behalf of participants at that session, a working group has prepared this discussion paper, further articulating the emerging strategic directions and recommending collective action for the province.

The paper is presented to the participants of the May 1997 planning session and their respective organizations to stimulate further discussion and a coordinated response for further consideration. The ideas expressed will help to formulate a province-wide strategy for the integration of technologies in learning and turn strategy into action.

5.2 Questions for Consideration and Feedback

A series of questions is posed below to encourage discussion on the broad range of issues and challenges identified in this paper. Discussion on other related issues is also welcome.

A process for providing feedback is outlined at the end of this section.

5.2.1 Learning Culture

1. What learning needs could be addressed effectively using technologies? How should these be identified?
2. What action would be needed within academic institutions to implement a TEL strategy for post-secondary education and training?
3. What commitment can or should your organization make to advance TEL?

5.2.2 Infrastructure and Delivery

1. How can the relative cost-effectiveness of the various media and technologies for learning be determined?
2. How should a "learning network" be defined and structured? What key functions should it perform? What "network" models are most appropriate?
3. What agencies should build and manage a learning network? Who are the key partners?

5.2.3 Coordination

1. What parts of the framework explored in this paper are appropriate for Saskatchewan's post-secondary education and training system? How should the priorities be ranked? What others should be included?
2. What are your organization's vision, plans and priorities for TEL? How can these be aligned with a provincial strategy or with other institutions?
3. What other government policies and initiatives should be linked with a TEL strategy?
4. What TEL models or practices can be adopted from other jurisdictions?
5. What action should be taken to implement TEL in Saskatchewan?

5.2.4 Management

1. What practical steps need to be taken to ensure a system-wide, collaborative approach to TEL? By whom?
2. What key functions, activities or processes must be in place to manage TEL successfully? Who is responsible for these?
3. What structures are needed to manage these? Where should they be placed?
4. Given limited resources, how should TEL be ranked among provincial and institutional priorities?
5. What are your organization's current investments in TEL? How might existing human, material, and financial resources be redeployed to support TEL?
6. How should the resources and investments of the key partners be coordinated?
7. How can the private and public sectors work together to provide resources for TEL?
8. How would TEL be advanced if there were no new resources?
9. Who are the key partners and stakeholders and what roles should they play in advancing TEL?

Delegates are invited to circulate and discuss this paper among their colleagues and constituents and provide **one coordinated response per organization**. Copies are provided in bound form, as well as and in loose form for copying. In addition, the paper is posted at:

URL: **http://www.sasked.gov.sk.ca/P/TELDP/**

Please send responses **by April 15, 1998**, clearly labelled **TEL Discussion Paper Response** and provide the following information:

Organization: ______________________________

Contact Person: ______________________________
(Name)

____
(Address) (Postal Code)

____
(Telephone) (Fax)

____
(E-mail)

Responses on paper or diskette may be forwarded to:

TEL Discussion Paper Response
Saskatchewan Post-Secondary Education and Skills Training
3rd Floor, 2220 College Avenue
Regina, SK S4P 3V7
Telephone: (306) 787-2712
Fax: (306) 787-9178

Responses may also be forwarded electronically to:

E-mail: TELresponse@sasked.gov.sk.ca

Appendix A
Technologies for Learning: Current Practices and Possibilities

1 The Global Context

Just as in other sectors of society, rapid technological advancement and change are contributing to significant changes in post-secondary and continuing education, training and apprenticeship. These changes are affecting conventional, face-to-face, campus-based programs, as well as distance education institutions that already rely on various technologies to deliver programs.

The University of North Carolina has embraced this challenge by adopting:

> *. . . a learner-centered approach to education, which integrates a number of technologies to enable opportunities for activities and interaction in both asynchronous and real-time modes. The model is based on blending a choice of appropriate technologies with aspects of campus-based delivery, open learning systems and distance education. The approach gives instructors the flexibility to customize learning environments to meet the needs of diverse student populations, while providing both high quality and cost-effective learning.*
>
> Institute for Academic Technology, University of North Carolina, March, 1995

The potential of this vision is in three elements: focus on the learner; increased flexibility in the learning process; and commitment to quality. These elements are key to the success of any program and any institution, regardless of the delivery methods. The role of technology in such a vision is to enable and mediate the learning process.

Communication technologies offer significant opportunities to increase interaction, flexibility and diversity, and thus quality and effectiveness of education and training programs.
New technologies, such as the World Wide Web (WWW) and virtual realities, enable new types of communication and experiences. For example, interpersonal interactions across web conferencing channels lead to the formation of a "virtual" community of learners.
The innovative pedagogy made possible by technologies, communication and experiences is evolving from the traditional synchronous, group, presentation-centered, "teaching-by-telling" forms of education to a learner-centered approach. In particular, advances in computer-supported

collaborative learning, multimedia/hypermedia, and experiential simulation can help to create shared "learning-through-doing" environments in any place, at any time, and on demand.

Effective application of these and other existing and emerging technologies can reshape education, and "blur the distinction between distance and campus-based learning, leading to what many have called the growing convergence of distance and campus-based teaching and learning" (Bates, 1996, p. 5). This convergence will have an impact on a diverse group of learners, on-campus, at a distance, and in apprenticeship and continuing education programs, as the parameters of learning collapse and learners begin to communicate with others around the world. This impact will be even more profound when these future workers take their technology-related skills into the marketplace.

Obviously, computing and communication technologies do not provide the solution to all instructional problems. Nonetheless, they play a significant role in the future of learning. Computing, for example, is as pervasive in education today as it is in all other aspects of society. The power resides not with technology itself, but with its appropriate use and selection for learning, depending upon the context in which it will be used. Research indicates that learning outcomes remain similar regardless of the technology utilized, providing that the instruction is effectively designed. Each technology possesses inherent advantages and limitations for learners and instructors. Effective instructional design considers strategies to maximize the advantages, minimize the limitations, and combine technologies to complement advantages and limitations.

It is important to distinguish between media and technology. A medium is a vehicle of communication that carries information and enables interaction between a sender and receiver. Media become instructional media when the information and interactions have an instructional purpose, to facilitate communication and enhance learning. Each medium supports a unique way of organizing and sharing information, often reflected in particular preferred formats or styles of delivery. Five forms of such media are widely recognized: face-to-face; print; audio; television; and, computing.

2 Media, Technology and Cost-Effectiveness

Four of the five instructional media can be supported by one or several different technologies.[1] The technology enables and mediates the particular, systematic arrangement of teaching and learning events designed to put knowledge into practice in a predictable, effective manner to attain specific learning objectives. The close relationship between media and technologies is outlined in the following table:[2]

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[1] As in any other discipline, the lexicon in education continues to evolve with new developments in practice. Terms such as learning technology, educational technology, instructional technology, delivery technology and mediating technology also refer to technology used in learning.

[2] This is not an exhaustive list — certain technologies are excluded because their application to the Saskatchewan context is limited. Radio, for example, is the second most common technology used in education, reaching

Medium	Technology
Face-to-face	Real objects, models, and photographs; projected visuals (such as overhead projector, slides and film); blackboard/whiteboard
Print (including graphics)	Paper-based print; computer
Audio	Audiocassette; compact disc-audio (CD-Audio); digital audio tape (DAT); telephone; audioconferencing; audiographics
Television	Satellite conferencing; videocassette; videoconferencing
Computing	Computer; telephone

Distinctions between media and technologies become blurred as they are integrated into single pieces of equipment or transmission systems. For example, WebTV equipment links a home television set, modem, telephone line and keyboard for access to the WWW, with the limitation that text and images on web pages can only be viewed, not downloaded or saved as with a computer. However, there are still significant differences in the bandwidth required for different media and in the educational applications associated with different media and different technologies within a single medium. For example, both a computer conference and a multimedia program are applications of computer technology. These applications, however, are different from each other, and are used to achieve notably different learning objectives. One must also acknowledge the distinction between one-way and two-way technologies. Two-way technologies facilitate interaction between the instructor and learners, and perhaps even more importantly, among the learners themselves.

Technologies provide an opportunity to instruct and learn differently, to accommodate the fundamental needs of a new and rapidly changing society. To take advantage of this opportunity, however, requires new approaches that exploit the unique features of various technologies in order to match the diverse needs of learners. In part, such approaches must be based on an understanding of what these technologies are, as well as their educational advantages and limitations.

To guide discussions regarding the development of a technology-enhanced learning strategy for Saskatchewan, the following section provides information on current and emerging use of technologies for education and training, within the provincial context, as well as the potential for combining technologies.

Cost-effectiveness and deployment costs for specific technologies are considered where possible. It should be noted however, that although it is relatively simple to determine the costs of using a technology, it is difficult to evaluate the benefits and to measure these, especially in monetary terms. Consequently, analysis of cost-effectiveness varies significantly from institution to institution, with each measuring different benefit factors. For example, if an institution delivers a televised class to a learner in a small community who would never otherwise have the

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hundreds of thousands of people in developing countries, but it has not been used widely in North America.

opportunity to take the class, it is certainly a benefit that the learner completes the class and perhaps increases his or her employability. How does the institution assess a monetary value for that benefit?

The difficulty in finding common variables to measure cost-benefit is illustrated by the example of one institution located in a large city. This institution delivered a popular evening class by television to several learning centres scattered throughout the surrounding suburbs and smaller communities. Since these learners did not require parking spaces, more students could be accommodated on-campus at the same time, resulting in increased revenue. Similarly, different variables are used to determine deployment costs for different institutions, different classes or content, and different technology.

Various standardized models and approaches to determine cost-effectiveness and deployment cost are being developed. Bates (1995) notes that decision-making about technology is complex and requires the consideration of numerous factors. Decisions are also driven by values and beliefs — by personal choice — as much as by technical considerations, many of which are not easy to compare quantitatively. Ultimately, an intuitive choice must be made, based upon a careful analysis of the situation.

2.1 Print

Print has been, and continues to be, the most widely used technology. Its importance must be emphasized. Print is not only capable of standing on its own as a technology, but it is also a critical component in a multi-mode approach, since it powerfully augments other types of technologies. The most common form of print is the book, or some variation thereof, such as, a course guide or course syllabus. At the same time, print itself is undergoing a transformation due to technological advancements. Both text and pictures are easily stored in the form of digitized data, and displayed on screens. This has implications for transferring print material into a digital format, which is then used as a foundation for computer-based learning.

Print	
Advantages	**Limitations**
• accessible, convenient and standardized, requiring no additional equipment to use • relatively fast, efficient and reasonably priced delivery by mail and courier; electronic delivery possible by fax and e-mail • infrastructure for publishing, distribution and marketing already well-developed • can carry large amounts of information in a condensed and portable form • ideal for courses requiring high levels of abstraction, and where factual, logical thinking or argument are required • although information is provided in a linear, sequential fashion, the sequence can be easily altered (and therefore individualized) by the instructor or learner, or by revisions • enables self-pacing, quick access to required information and easy review	• use of color adds greatly to the cost of production • cannot represent motion • inappropriate for development of social and motor skills • extensive instruction strictly in print can be boring; span of study time and correlating design are very important • weak potential for interactivity; must be complemented by an instructor or tutor • in distance education applications, long "turn-around" time of assignments and tests • learning from print requires high skill level for the learner and designer of instruction • low novelty level except in electronic publishing • long time required to develop high quality print; once produced, is difficult and costly to change
Factors influencing cost: major costs associated with development (such as academic time and instructional design; reducing these costs reduces quality), rather than printing and distribution; necessary tutor support; number of students in a course and expected course life; and electronic delivery (reduces costs — except academic time and instructional design — and improves flexibility of production).	

2.2 Audiocassette, CD-Audio and DAT

Audiocassettes are a one-way technology. Cassettes are inexpensive, easy to use, accessible and generally effective; however, they are not exotic and thus tend to be ignored and undervalued. In combination with other learning technologies, in particular, print, audiocassettes can be highly cost-effective. The evolution of audiocassettes is seen in such technologies as compact disc audio (CD-Audio) and digital audiotape (DAT). These emerging audio technologies share similar advantages and limitations as audiocassettes with a few notable differences: the equipment to play back CD-Audio, and especially DAT, is not nearly as accessible; playback is technically superior due to the digital storage format; overall production and distribution are more expensive; and the capability to record over these devices is just now emerging, although it is very costly and inaccessible.

Audiocassettes	
Advantages	**Limitations**
• audiocassette machines are very accessible • can be used to record radio programs, lectures or lessons (often delivered face-to-face), then made available with supporting print • facilitates delivery of non-sequential material through control features of cassette players (stop, re-wind and repeat); enables tight integration with other learning material • replay facilitates development of higher level learning skills • increased level of learner and instructor control • when well designed and combined with other technologies can accommodate high levels of interactivity between the learner and instructional materials • easily designed and distributed without the need for complicated studio facilities • relatively easy to change and up-date	• long and uninterrupted use can be boring without occasional visual stimulus • design and development of supporting print material is more demanding if the control features of the cassette are exploited (in other words, if the learner must be directed to stop at a point in the cassette, read from the print, and then re-start the cassette) • little novelty • production is dependent on speed of print design and development which tends to be slow
Factors influencing cost: production; and distribution.	

2.3 Telephone, Audioconferencing and Audiographics

The telephone, audioconferencing and audiographics represent the two-way audio medium. Saskatchewan has a long and distinguished history in the development and implementation of a superior telephone network infrastructure. A simple, standard telephone and a telephone network enable voice communication between instructor and learner, and among learners themselves. In contrast, audioconferencing requires slightly more sophisticated equipment. It uses a "bridge" — a special telephone switchboard that allows several lines to be connected simultaneously so that someone at one site can hear and be heard by all the others. If several learners are participating in an audioconference from one site, a special audioconferencing unit or a telephone loudspeaker and individual microphones provide the best sound quality. If an audioconferencing call is placed directly to a learner's home or office, a telephone equipped with a built-in microphone and loudspeaker provides reasonable quality.

The emerging technology, audiographics, enables the parallel transmission of images with voice over a standard telephone line. With a personal computer, special plug-in board and software, graphics (including animation) and text can be generated by an instructor and learners. The package of data and sound is transmitted over the telephone line, and received at another site using similar equipment. The transmission of information back and forth occurs in real time. The visuals can be recorded on one track of a standard audiocassette, with sound on the other track. Thus, with careful design and editing, an integrated audio-visual package can be prepared, and played back on an audiocassette player or prepared in advance for telephone transmission.

<table>
<tr><th colspan="2">Telephone, Audioconferencing and Audiographics</th></tr>
<tr><th>Advantages</th><th>Limitations</th></tr>
<tr><td>• although access varies with such factors as regions, age and income groups, basic telephone services are available to the majority of the population
• development of ISDN technology allows the transmission of voice and data over one telephone line, thereby reducing line costs for audiographic transmission
• enables instructor to communicate effectively one-on-one with a learner; usually in a tutoring or counselling situation as a complement to print and/or other technologies used for primary instruction
• enables instructor to communicate with a group of learners at one location (commonly at another institution); usually used for direct instruction
• enables instructor to communicate with learners (either individually or in groups) at individual sites (either at home or in an institution) for a variety of instructional purposes
• audioconferencing easily integrated into campus-based instruction, as a direct extension of the classroom employing similar instructional approaches
• provides a very good interactive component lacking in other learning technologies
• potential for novelty with recent advances in voice, data and image transmission
• courses can be set up quickly, and are easily adapted and modified as new knowledge is generated</td><td>• audiographics generally requires use of two telephone lines (one for graphics and one for voice) and specialized computing facilities; therefore, access limited to institutions or learning centres
• two telephone lines increase usage costs, especially during prime time
• audioconferencing requires skills to manage
• size of audioconferencing bridge determines number of sites that can be linked simultaneously; also constrained by number of learners that can learn effectively this way at any single time
• inhibits immediacy and spontaneity
• instructors must consciously use techniques to ensure participation from all learners
• lack of visual cues
• learners must be available at a set time and usually a set place on a regular basis
• may require technical staff to handle bookings and technical support
• tendency for audioconference courses to be added to an instructor's workload in campus-based institutions without recognition of the additional time required for effective development and delivery</td></tr>
<tr><td colspan="2">Factors influencing cost: role and purpose of instruction; number of learners (costs are proportionate to number of learners); distance between instructor and learners; pricing structure of telephone company; availability of specialty telephone services (such as fibre-optic networks and Integrated Services Digital Network, or ISDN); extent of regulations governing competition and monopoly of services; policy of the originating institution regarding payment of line charges by the instructor/tutor and learners. Bates (1995, p. 173) states: "Nowhere is there greater variation between institutions in cost policies than in telephone teaching. Given this wide variation in practice between institutions, any example chosen of the actual costs of telephone teaching is likely to have limited relevance."</td></tr>
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2.4 Satellite Television, Videocassettes and Videoconferencing

Grouped together, satellite television, videocassettes and videoconferencing represent what is commonly called instructional television. Satellite television in Saskatchewan assumes a unique format. Educational programs originate at one of several different studios. The signal is collected and beamed up to the Anik satellite, which then redirects the signal to the receiving sites. Approximately 150 sites across the province are equipped to receive and decode the digital transmission signal. The one-way nature of satellite television is augmented by telephone and fax for the integration of two-way communication. Videocassettes are used to record and store television material.

One of the fastest growing emerging technologies is videoconferencing. Videoconferencing links two or more sites, typically through standard telephone lines, or through fibre-optics, cable or microwave transmissions. A special videoconferencing "bridge," similar to the audioconferencing bridge, is also required to link more than two sites. Each site is equipped with a special television monitor and a camera (or cameras). During a videoconference, the television monitor at one site splits into smaller screens that show the other sites. The equipment enables two-way video and audio communication between participants. In other words, each person can see and hear people at all the sites connected at different locations.

Satellite Television, Videocassettes and Videoconferencing	
Advantages	**Limitations**
• widespread availability of videocassette machines • videocassettes provide back-up to print-based individual home study, or enable group activity • videocassettes give learners increased flexibility and control over their learning; learners can view a videocassette at a time and place that is convenient for them and use the stop and replay features to review material • novelty increases with interactive components • enables rapid change of content from year to year if the course is being re-broadcast each time it is offered • provides rich audiovisual stimulus	• satellite television and videoconferencing require special equipment and communications facilities; therefore, only found in designated local centers • use of videocassettes in group activity needs to be designed into the complete instructional package, or instructors/tutors need more encouragement to integrate videos in face-to-face sessions • potential for interactivity decreases as numbers increase during live interactive programs • a "presentation of information" approach to instructing inhibits interaction • instructors require more time for preparation and delivery, and adaptation of techniques different from face-to-face instruction • scheduling is inflexible • professional television technical staff need to adapt to instructional television • at a minimum, videoconferencing requires two telephone lines; motion and picture resolution is just adequate • for videoconferencing to transmit movement and good picture resolution, a minimum of six telephone lines are required; can become very costly • linking more than two sites by videoconferencing requires a special "bridge" with additional costs • different standards in videoconferencing hardware exist, making it difficult to connect with sites in other provinces or countries
Factors influencing cost: in videocassettes, it is cost of distribution rather than production; cost structures for satellite television dependent on method of production and distribution; hardware, software, transmission lines and transmission rates (dependent upon the required bandwith) influence the cost of videoconferencing; expense of live, interactive television makes pre-recorded instructional television combined with another technology to facilitate interaction a much better option; consortium approach (for example, a single course for students from a number of different institutions) can reduce costs and create pedagogical advantages; costs may be offset by a strong and growing market for original, good quality instructional television; timing of decisions to invest in particular television-based technologies is critical (for example, two-way videoconferencing is developing quickly thus reducing equipment and transmission costs).	

2.5 Computer: Computer-Based Learning (Including Multimedia)

Perhaps no other technology has evolved as rapidly as computer-based (and computer-mediated) technology. Advances in computing speed, memory storage, hardware peripherals, and the integration of full-motion video and high quality audio have increased the potential use of computing in instruction and learning. Computer-based learning encompasses computer-assisted learning (CAI), including multimedia — a computer program that integrates video, graphics, audio and text; computer-managed instruction (CMI); and computer supported learning resources (CSLR).

Technological advances have had an impact most significantly on computer-assisted learning, an assembly of instructional activities using the computer. Traditional modes of CAI include tutorial, drill and practice and instructional game applications. Emerging modes include modeling, simulation and problem solving applications. Effective use of these applications is only possible with advanced computing resources, since they require very fast processing speeds and vast amounts of storage space. Traditional modes of CMI include testing; prescription generation, where the program may prescribe that the learner reviews a portion of material because he or she failed a test; and record keeping. CMI can independently support any type of instruction and is commonly used in tandem with CAI. Because CMI developed into a robust learning technology requiring minimal computing resources, it has not been affected as much by advancements in computing as CAI. Computer supported learning resources (CSLR) provide access to information through a computer program that facilitates the retrieval, examination and manipulation of data, but does not provide any instruction in and of itself. Modes of CSLR include databases, telecommunications, expert systems and hypermedia.

Computer-Based Learning (Including Multimedia)	
Advantages	**Limitations**
• highly effective in instruction where repetition, mastery and practice are important • potential for high level of interactivity, and self-paced individualized instruction • developments in multimedia are increasing the appeal of pre-programmed computer-based learning • software developments are making it easier and less expensive to create high quality learning materials • designing and developing multimedia is becoming easier; instructors and learners will find it easier to construct and adapt learning materials, thus widen the range and flexibility of teaching approaches	• substantial numbers of learners still do not have access to computer at home, and fewer have modems; higher end computing equipment, such as that required to run advanced multimedia packages, will be even more scarce • cost of development is decreasing; still a shortage of good-quality, pre-prepared software • material not often well-designed for instruction • designing good quality educational courseware requires a team approach and a high level of instructional design skills
Factors influencing costs: difficult to estimate for four reasons: power of technology is increasing rapidly, thus enabling better instructional presentation, and labour costs associated with design and development are decreasing; as the technology improves, so does the range of applications that have significantly different cost implications; no stable costing model exists; very little research on production and distribution of multimedia materials; it enables the presentation of information and interaction difficult to achieve with other technologies.	

2.6 Computer: Computer-Mediated Communication

Computer-mediated communication is distinguished from pre-programmed computer-based learning by two characteristics. First, the learner is in contact with the instructor and with other learners. Second, remote databases can be made accessible through electronic networks, and information retrieved from a database can be stored for later use. The Internet is considered one such database. Through mainly textual messages, a learner equipped with a computer and communications software and connected via a modem and telephone line can communicate with similarly equipped learners and the instructor, or use a database. Interaction thus occurs *through* the computer, rather than *with* the computer.

Computer-mediated communication includes electronic mail (e-mail), bulletin boards, computer conferencing, databases, and the emerging technologies of web conferencing and desktop videoconferencing. Web conferencing enables the same kind of interaction as computer conferencing, but is distinguished by its ability to integrate graphic and audio material. Adding a small camera, microphone and software enables desktop videoconferencing. A learner with one set of such equipment is able to see and hear another learner with similar equipment.

Computer-Mediated Communication	
Advantages	**Limitations**
• extremely flexible; can be an adjunct or primary delivery method • very effective for: developing academic discourse; collaborative and project work; building knowledge and experience of all participants; increasing equity of participation; cross-cultural participation; developing reflective writing skills; overcoming social isolation; emotional involvement; ready access to help and support; feedback to and direct learner contact with the central academic team • enables active and interactive participation, free of constraints from time and location; increases learner control • strong novelty value • very easy to update course material and add perspectives on issues that arise during a course	• access to good quality telephone lines is essential • in most situations, the telephone cannot be used for voice communication when being used for computer communication (emerging connection technologies such as high-speed cable and ISDN will alleviate this limitation) • modem is additional hardware expense • information overload, emotional absorption and limited symbolic representation (text-based) • tends to be added to current courses without adjusting the involvement of other technologies being used; can easily lead to course overload • low levels of participation and low levels of thinking, if simply used to present information • instructor and learners require training for use • institutions must consider legal and ethical issues (for example, racial comments in a computer conference), as well as control, cultural change in computer departments and resource re-allocation
Factors influencing costs: institution-related (research and planning, hardware, software and central network costs, and technical support); student-related (hardware and software costs); telephone line; and tutor-related costs (tuition, hardware and software, telephone and tutor training).	

2.7 Convergence in Computer-Based Technologies

The possibility of combining technologies to exploit the advantages and compensate for the limitations of each is becoming evident in recent developments. For example, the recent development of a storage format will potentially merge computer-assisted instruction with Internet-based computer-mediated communication in a seamless fashion.

Known as a shocked or streamed CD-ROM, this presents instruction to the learner in one, or a combination, of the CAI modes. A learner may be using this technology to work through a multimedia CD-ROM tutorial on genetic cloning. At the end of the tutorial, the option to click on a button titled "Current Developments," automatically brings up the computer's web browser and connects it directly to the Dolly WWW site (Dolly is the infamous sheep who was cloned from the cell of another sheep). In this manner, a shocked CD-ROM can be designed to contain static, relatively constant content, which is important for the costly process of CD-ROM design and production, but retain the capability to connect to current or changing content in a relatively simple fashion.

3 Realizing the Possibilities

The real value of technology for education is in its capacity to improve and enhance the learning process. The following examples are provided to demonstrate the various ways in which technologies have been used to facilitate education and training. It is worth noting that while these exemplify the possibilities and serve as models in some cases, it is also possible to go beyond or improve on the application described.

3.1 Math Readiness

In September 1995, the Extension Division and Department of Mathematics and Statistics at the University of Saskatchewan formed a partnership to develop a Math Readiness course. This course was designed to bridge the gap that many students experience between the mathematics skills they have acquired and retained from their high school training and the skills that are expected in post-secondary programs with significant quantitative components. The Math Readiness course began and continues as a brief, intensive "summer camp" held on-campus just before the start of the university year. Students attend university-style, face-to-face lectures in a large class followed by problem-solving in small groups that are facilitated by a tutor. The course evolved to include a comprehensive Math Readiness Course Manual, which is also available as a print-based independent studies package, and evening classes held during the university year.

The current evolution of Math Readiness takes advantage of emerging technology. With support from the PSEST Multimedia Program Development and Support Fund, the print-based materials were transformed to interactive tutorials on a web site. The technology of JAVA Applets was used to construct a Virtual Mathematics Laboratory (VML), with which students are directed through the manipulation of graphical representations of mathematical objects. This capacity to conduct interactive mathematical experiments is a feature of the emerging technology that was never available to teachers or students in the traditional classroom. In addition, learners who are more visually oriented benefit from the VML. The WWW-based course will track each student's performance and adapt the activities presented to the student to match his or her personal learning pace and style. This distance-delivered version of Math Readiness will be further enhanced by the production of a series of videos.

Math Readiness provides basic training in mathematics. The changing economy demands a higher proportion of the workforce to be skilled in some technological area than was the case a decade ago. Increasing numbers of mature students are entering or returning to university after some years in the workplace. Many of them are attracted to science and technology-oriented programs, but unfortunately, their mathematical skills have deteriorated rapidly with disuse. In addition, Saskatchewan has many small and remote schools that are not able to provide the same range of opportunities available to students who attend large schools with a diverse and qualified faculty. Students from these schools, including many First Nations people, are sometimes at a disadvantage in their mathematics background. Access to a distance-delivered Math Readiness course addresses these various needs.

Math Readiness also exemplifies the potential for partnerships in delivering technology-mediated courses. SaskTel is collaborating in the distance delivery of the course. In addition to collaborating on research opportunities, Simon Fraser University will be using the materials to deliver a Math Readiness immersion course. Cameco has expressed an interest in using the WWW-based course for the training and continuing education of their employees.

3.2 Interdisciplinary Continuing Education for Health Professionals

In 1996, the Faculty of Continuing Education at University of Calgary, Health and Community Studies at Grant MacEwan Community College, and Alberta Health worked co-operatively to provide interdisciplinary continuing education throughout Alberta, using compressed videoconferencing. The pilot project responded to the changing environment of the provincial health care system, shifting away from the hospitals into the community, community agencies and the home. As well, different organizational structures developed. Blended teams, consisting of members from various health care disciplines, increasingly replaced the traditional team structure within single health care institutions and organizations.

Three primary educational activities were conducted using the technology:

- instructional sessions for members of the project's Steering Committee and instructors;
- needs assessment to determine the learning needs of health disciplines related to interdisciplinary practice in health care; and,
- continuing education sessions on selected topics in interdisciplinary health care practice.

Compressed videoconferencing was used to conduct the educational activities. Broadcasts were live and interactive, enabling participants at each of the five sites to see and hear everyone at all the other sites. The video quality was not the same full motion quality typical of broadcast television. Rather, the compression ran the video at a slower frame, making motion appear stilted and jerky. However, it was less expensive than full motion, and thus more cost-effective for continuing education. In addition, participants did not appear to mind the difference in quality.

The interactive capabilities of videoconferencing matched the objectives of the various educational activities. For example, the needs assessment included:

- **a keynote address** on the topic of emerging teams within health care restructuring by an expert in the field. The address originated from the presenter's workplace at Columbia University in Ohio, and was delivered by videoconferencing to all five participating sites in Alberta. Questions, answers and interaction were an integral part of the presentation.
- **a panel discussion** followed, with the panel moderator located at one of the sites, and panel members located at other sites across the province. Through the videoconferencing link, panel members contributed to a discussion of the changing organizational structures and changing interdisciplinary team structures in selected regional health authorities.
- **needs assessment**. Local small group discussions at each of the sites provided the means to identify the knowledge and skills needed for effective interdisciplinary practice. The videoconferencing link was disconnected during this discussion. After the local discussion finished, the sites were again connected by the videoconferencing system, and participants reported the results of their discussion to the other sites.

All sections of this activity were supported by extensive print material.

The needs assessment portion of the program resulted in the delivery of workshops and conferences on selected topics related to effective interdisciplinary practice. The content again matched the technology. Topics such as *Team Building Workshop*, *Issues in Team Work* and *Collaboration*, and *Strategic Planning for Effective Team Action* fully used the interactive capability of videoconferencing. Thus, in the project, two important needs were met with the help of technology:

- the need for several parties to work together to solve their common problems; and,
- the need to provide upgrading programs to professionals who were being displaced but whose home and community responsibilities prevented them from travelling.

This new medium allows participants to respond to new challenges in work and learning, and accomplish what has not been done before. This is much different than using technology to duplicate existing classroom activity.

3.3 Digital Zoology

In 1987, when Jon Houseman first began teaching Zoology at the University of Ottawa, *Animal Form and Functions* was a first year Biology course with enrolments of more than 300 students. He discovered that traditional media material, such as film and slides, to support delivery of this course were no longer available. Films, many over thirty years old, were still sitting in the media libraries of some universities, but in a deteriorated state. In addition, there was no budget either to replace these, or for a projectionist to run them. Class sizes were beginning to grow and even if the films were available, the room required for the class was too large for their use during a lecture. Houseman also realized that, while existing materials for his course were of poor quality, none were even available for the French version. Recognizing that the presentation of visual material was a critical element in the course, Houseman decided to rectify the lack of supporting media.

To improve the illustrations in the lab manual, Houseman and his associates, with permission of the textbook publisher, used a black and white hand-held scanner to create a digital version, and CorelDraw 2.0, to label outline drawings based on those in the textbook. In the following year, these images were combined with scanned photographs from the textbook, for the first digital presentations in the classroom. To address any potential student concerns, both the English and French versions of the course were split in the following manner: one half of the courses were taught with the support materials supplied by the textbook supplier and the other half using the self-produced digital materials. The students overwhelmingly preferred the digital lectures, reporting that they learned more from these and understood the material better. The digital lectures enabled students to see the practical application of the theory and information being discussed in class. For example, when Houseman discussed the three main body types in sponges and the relationship between body type and size, images of real sponges reinforced the theory.

Houseman and his associates identified several obstacles with the use of new computer technologies in teaching during this initial process, including the scarcity of digital materials and the impact of copyright laws on the reproduction of electronic materials from existing media. To solve these problems, they created an image database of copyright free materials for Biology instructors called BIODIDAC. An illustrator was hired to redraw many of the classic illustrations used in zoology. Labels in both French and English were added using a method that enabled all users to customize the illustrations to suit their course materials. For example, the line drawing of a sponge body wall cross-section could be used by one instructor to highlight the pores, and by another to illustrate the body cavity. Digital photographs of preserved and dissected specimens, and microscope slides, were added to the growing database which now has more than 3,000 images. All images are available for royalty-free educational use on the BIODIDAC web site. In appreciation of this initiative, zoologists from other universities have contributed images to expand the database.

The material created with BIODIDAC has been synthesized into a CD-ROM-based multimedia application entitled *Zoologie numérique/Digital Zoology*. The CD-ROM explores the diversity of animal life, starting from the highest level of formal classification, such as Porifera (sponges), and ending with the lowest level, such as Grantia (a genus belonging to Porifera). All of this is integrated with individual modules illustrating the laboratory materials that the students work with. Using computers within the laboratory rooms, students work through the multimedia program at the same time as they work with the actual specimens and slides. The bilingual CD-ROM resembles a type of electronic, multimedia atlas. The students use it consistently and with enthusiasm. Although it was not a formal requirement in the course, an average 80% of the students in the course logged into the program for an average 45 minutes per week during the semester.

3.4 Biology at a Distance and Close to Home

Natural science courses are underrepresented in both off-campus face-to-face and distance delivery in Saskatchewan, primarily because of the lack of access to laboratory resources. In the fall 1997 semester, the University of Regina piloted the delivery of Saskatchewan's first distance education core Biology course, with a full laboratory component. Using a multi-mode approach, the course was delivered to approximately fifty students across the province. Lectures reached fourteen receiving sites over the Saskatchewan Communication Network's (SCN) satellite conferencing system. During the pilot phase, the laboratory component was delivered face-to-face at designated cluster lab sites in Estevan, La Ronge, Regina, Swift Current and Weyburn.

With the support of the PSEST's Multimedia Program Development and Support Fund, one of the laboratory exercises is being converted to a multimedia format. This particular exercise is the first of four laboratory sessions that introduce students to classification in the Animal Kingdom. Students will examine representative species through a series of still pictures, video clips and accompanying text. The multimedia program will also encourage students to practice their classification skills in review exercises, and formally test their knowledge in a post-test.

A multimedia version of this laboratory exercise is advantageous because it:

- provides a level of interactivity and self-testing difficult to replicate in the face-to-face lab room;
- overcomes the need for distance education students to travel to laboratories at designated cluster sites;
- provides access to specimens and slides that may not be readily available, or are available only at significant cost, both on-campus and off-campus;
- can be designed as a stand-alone instructional package for sites without access to required specimens and slides, or as a guided tutorial for sites with access to specimens and slides;
- improves access to a natural science course for all learners in the province, regardless of their location; and,
- strengthens the ability of regional colleges and SIAST to provide a diverse selection of first year off-campus courses, particularly to northern communities.

3.5 Virtual-U

An online learning environment, called Virtual-U, has been developed by Simon Fraser University with the support of a consortium of 30 Tele-Learning Network Centres of Excellence located on university and college campuses across Canada. Virtual-U integrates the features of computer-assisted instruction, computer-managed instruction and computer-mediated communication into a web-based delivery system. It also uses online instructional design. Virtual-U is a server-based software system: students on a personal computer must connect through the Internet or a direct dial telephone call to a central computer to gain access to the full capabilities of the software. Instructors and students log on to a site, and enter an identification number and password. Using the visual metaphor of a campus, the students enter a "classroom," which transcends the space and time of a face-to-face classroom.

Virtual-U offers a unique system of support for both the instructor and student before, during and after course delivery. The instructor is supported by a series of online instructional guidelines for online course delivery based on the principles of collaborative learning, a method of course delivery that is supported well by the web environment. Collaborative learning encourages processes by which the instructor and students learn from each other. Instructors can also scan sample courses for ideas on the multiple ways to customize online courses. A course structure tool enables instructors to organize course content and outline by providing links, files and instructions to students.

The student browses a Course Space for class assignments, notes and scheduling. This information is often provided in the form of links to live pages. The student also collaborates with other students and the instructor within VGroups, Virtual-U's conferencing tool. Independent learning is supported by online group conferencing, which can be structured by either the instructor or student. Classes take place in an asynchronous environment, adapting to the time, availability and schedules of the participants.

Using the Virtual-U Gradebook, the instructor can calculate student marks for individual assignments, and for the overall course. A student can view his or her mark, as well as viewing where the mark falls within the class grade range. Gradebook also provides space for free-style evaluative comments, which can be used exclusively or in addition to numeric grades.

Currently, approximately 15 post-secondary institutions across Canada provide access to Virtual-U, including McGill University and the University of Toronto. In the spring 1997 semester, 700 university and college students across the country participated in Virtual-U.

3.6 Computer-Mediated ABE Materials

With support from the PSEST's Multimedia Program Development and Support Fund, SIAST Woodland Campus is creating a multimedia program entitled Academic Preparation for Science (APS). This program encompasses seven modules: four introductory modules covering topics related to Science and Us, World of Work, Decision Making and Learning Science; and three modules focusing on basics in biology, chemistry and physics. The content reflects views and interests of adult students in Saskatchewan, and the interactivity enabled by the use of media to deliver the information. The project will ultimately produce learning materials that can be offered by traditional delivery with interactive resources, by CD-ROM and through the Internet to meet the diverse needs of adult learners in Saskatchewan.

The program is intended to enhance possibilities of success for adult students in educational and work-related pursuits, and to prepare students in science so that they may be successful in further academic secondary science training. This program will also assist educators and students with processes related to integrating knowledge, skills and attitudes. It will be a companion to existing adult education programs, as well as a bridge to further studies in science.

A multimedia approach to the APS is designed to:

- provide interactive, culturally sensitive learning materials with testing capability;
- create a bridge between Adult Basic Education 10, Adult 12 and post-secondary programs in science for adult learners preparing to enter the provincial Adult 12, post-secondary or apprenticeship programs; this bridge is especially critical for First Nations adult learners;
- develop learning materials for use in independent or group settings, and provide further learning options and resources using various computer formats such as online discussion and CD-ROM;
- build partnerships with other institutions so that the materials developed are suitable and available to learners and instructors throughout the province; the partnership model can be used as a prototype for future projects; and,
- complement related resources being developed through other projects (such as Woodland Campus' Online Testing project), incorporate existing resources and develop additional resources to bridge existing gaps.

3.7 Mixing and Matching

The University of Saskatchewan offers a selection of first- and second-year degree credit courses using a multi-mode delivery system. A multi-mode course typically builds upon an existing print-based course. Thus, the bulk of the course content is covered in an extensive course package designed for independent study. To overcome the limited opportunities for interaction in print, an audioconferencing component is added. Students meet weekly at a designated off-campus, regional college site (up to a maximum of four sites) for the audioconference. The sessions are designed to facilitate content-related discussion, and questions and answers. An additional print-based package sets the parameters for the sessions. The instructor leads the audioconference either from Saskatoon or from one of the designated sites. In addition, the instructor travels from site to site during the semester, usually visiting each group of students twice. Thus, the students also have the opportunity for face-to-face interaction with the instructor. Approximately two hours are scheduled for the designated site session. The audioconference usually does not take up the entire time, and the extra time is used for students to interact with their peers at the site, to view videotapes, or to speak with the instructor when at their site.

3.8 Conferencing on the Prairies

The University of Regina and University of Saskatchewan, supported by funding from the Department of PSEST, embarked on a pilot project to examine the viability of computer conferencing in Saskatchewan. The University of Saskatchewan provided the computer conferencing file server, FirstClass software and technical support, and designed a print manual to guide the installation and use of the software. The University of Regina organized a provincial support system, including technical support, training support and hardware, through SIAST and the regional colleges. The University of Regina also designed and delivered a *Training of Trainers* workshop for the personnel at these institutions involved in helping the students.

The first courses delivered using this system have been successful. One such course was University of Regina's Educational Psychology 322: Students With Special Needs. Fifteen students, including students from on-campus in Regina and from off-campus across the province, registered in the course.

Computer conferencing was used as the primary means of delivering the course. This technology accommodated the discussion and resource sharing that were critical elements of the content. An excellent textbook supplied the theory. A face-to-face weekend session on-campus in Regina was provided to develop students' skills in assessing the needs of special needs students, and recommending remedial approaches as part of a team. The instructor also encouraged contact by telephone when necessary. A print-based course package guided all activities in the course.

The course suited the technology and delivery because:

- it is part of the accreditation required by teachers to work in the field of special education;
- many teachers who work in special education still do not have credit for this course; which is difficult for teachers outside of Regina to attend; a comparable course at the University of Saskatchewan is at the graduate level, and thus also difficult for students outside the city to attend;
- it is important for the teachers to work in the context of their community, since they rely on community resources for their special needs students;
- it is also important for the teachers to build a support/resource network; special needs teachers often work in isolation within their school; and,
- computer conferencing suited the instructor's approach to the course content, with only a few exceptions that could be met by other delivery technologies.

3.9 Turning a Limitation into an Advantage

To train apprentice automotive mechanics in Australia, a technical institute is using a delivery technology in a way that highlights the possibilities of turning a technology's limitation into an advantage. As part of a comprehensive training delivery system that uses primarily print and video, the apprentice mechanics also participate in compressed video sessions. As was mentioned in the first example, compressed video runs at a slower frame speed, making motion appear very slow, stilted and awkward. This characteristic is often described as a limitation of compressed video technology. In this case, the instructor specifically uses compressed video for hands-on demonstrations because of its "limitation." For example, the instructor may wish to show his class how to remove a particular piece of the engine, demonstrating the procedure from a videoconferencing site to other sites across Australia. As the instructor goes through the steps, the compressed video arrives at the other sites slowly enough that the students can follow the procedure — step by step — on the engine at their videoconferencing site.

3.10 Apprentice Level I — Parts Management Program

With support from the PSEST's Multimedia Program Development and Support Fund, SIAST Kelsey Campus is converting the Level I Partsperson Apprenticeship training program from traditional classroom delivery to workplace-based learning using multi-mode delivery.

Six core courses in the program are being designed as print-based independent studies packages. Assignments for the courses will be generated from a provincial parts database currently available to all parts managers in the province. To improve accessibility and ease of use, the database would be posted to the Internet. The assignments will be posted to a web page bulletin board by the instructor, or distributed directly to the trainee through e-mail or the regular mail system. In turn, trainees submit their assignments by e-mail. A confidential program test bank will generate exams. Live Internet tutorials and one-on-one computer-mediated communication between the instructor and trainees are two additional options available to support the learning process.

After completing the core courses, trainees would have access to the associated studies courses through their local regional colleges to complete the Level I Apprenticeship training.

There are numerous benefits in providing this apprenticeship program through multi-mode, distance delivery:

- it enables larger enrollments to meet the increased need for training of this nature;
- training is available directly to the workplace; this eliminates relocation costs, travel expenses, loss of wages and many other expenses associated with training on-campus; reduces disruptions to the trainee's home life; it also expands the employer's role to one of a proctor or mentor, reinforcing the learning concepts of the training program;
- it improves flexibility of delivery, by making the program available by classroom instruction, independent studies print package or online communication through the Internet; these three options make the program accessible to virtually anyone within the province and potentially to those outside the province; and,
- it permits self-paced learning at a time and place convenient for the trainee.

4 A Decision-Making Model

As was suggested at the beginning of this **Appendix**, in order for technology to be effective as a learning tool, it must be used appropriately, in a manner best suited to the situation and to the needs of the instructor and learners. There are several established models to guide the process of media selection. One well-known model is outlined by A.J. Romiszowski in *The Selection and*

Use of Instructional Media (1988). However, these models have limited applicability because they are mainly designed for a face-to-face setting, and rarely refer to a distance education setting. They also focus on matching a specific medium to a particular instructional activity. In addition, non-instructional, practical considerations such as costs and organizational requirements are rarely addressed. It is thus very difficult to make strategic decisions about which learning technologies to choose using these models.

Bates outlines an alternative model for technology selection and application in the text, *Technology, Open Learning and Distance Education* (1995). Called the ACTIONS model, this framework:

> *. . .comprises a set of questions that need to be answered, irrespective of the type of institution or distance teaching programme, to enable appropriate decisions to be made regarding the choice and application of different technologies; in other words, these questions need to be asked in any context; the answers, though, will depend on the context.*
>
> Bates, 1995, pp. 35-36

Although Bates developed the model within the open learning and distance education environments, its application extends beyond these settings. The following is a brief summary of the ACTIONS model, and questions for consideration at each step of the model.

	Factor	Definition	Questions to Consider
A	Access	• accessibility of a specific technology for learners • flexibility of a specific technology for learners	• What are the priority target groups to be served? • What is the most appropriate location for these learners?
C	Costs	• cost structure of each technology • unit cost per learner	• What will be the average cost per student study hour for a particular technology for a given number of students over the expected life of courses to be supported or delivered by that technology? • What will be the costs for necessary additional services and/or technologies?
T	Teaching and learning	• types of learning needed • matching instructional approaches to best meet these needs • best technologies for supporting specific teaching and learning	• What kinds of learning need to be developed? • What instructional strategies will be employed to enable the learning needed? • What are the unique characteristics of each technology, and how well do these match the learning and teaching requirements?
I	Interactivity, user-friendliness and learner control	• kind of interaction the technology enables • ease of use	• Does the technology enable simultaneous or delayed communication, one-way or two-way communication, permanent or transient communication? • To what extent can the learner can control his or her learning?
O	Organizational issues	• organizational requirements, and barriers to be removed before the technology can be used successfully • changes in the organization that need to be made	• What opportunities or threats exist in the external environment that may influence the choice of particular technologies? • What are the internal organizational requirements, and the barriers to be removed, before this technology can be used successfully?
N	Novelty	• how new is the technology	• Are there sources of funding available to offset implementation because it is a new technology?
S	Speed	• speed with which courses can be mounted and changed with this technology	• How quickly can a course be prepared and changed with this technology?

There are no simple solutions to selecting and using technologies. The choice is being complicated further by the introduction of new technologies and new educational initiatives.

The ACTIONS model, while not necessarily the ultimate guide to decision-making, raises important factors and questions related to the integration of technologies.

5 Summary

Saskatchewan has a long and distinguished history of using technology for learning, particularly in distance education. This experience has fostered a significant level of collective expertise and infrastructure that provides the foundation for a new vision for both campus-based and distance learning. To build on the foundation, emerging technologies promise a level of interaction and flexibility to the learner that is difficult to replicate with existing technologies. However, these demand substantial investments in equipment, bandwith, instructor training, and so on. Decisions to use technology in learning must consider these factors, along with the factors summarized in the ACTIONS model.

As is evident in this section, technologies provide an opportunity to instruct and learn differently, in a way that can meet the fundamental needs of a new and rapidly changing society.
The decision to integrate technology in learning will not be an easy one. Whether it is an intuitive decision or one that is carefully based on precise factors, technology has a role in enabling and mediating the learning process.

Appendix B
Innovation in the Post-Secondary Education and Training Sector

Saskatchewan has a long history of innovation in distance learning. From the original correspondence courses in 1925, later supplemented with radio and telephone tutoring, various modes are now available and being combined. These include satellite television, audio and videocassettes, computer diskettes, audioconferencing, computer conferencing, CD-ROM and the new high-speed telecommunications network between Regina and Saskatoon.

This **Appendix** contains two sections that offer a concrete illustration of current and emerging use of communications technologies to support post-secondary education, training and labour market services. Section 1 provides an overview of courseware, learner support resources and instructional strategies being developed by the universities and SIAST with support from the Multimedia Program Development and Support Fund. Section 2 is a modified version of a document currently being assembled within PSEST for consideration in developing technology applications to support the Training Strategy. It contains an inventory of initiatives underway with support from various sources.

1 Multimedia Program Development and Support Fund, 1995-1996 and 1996-1997

The provincial Multimedia Learning Strategy, launched in May 1995, promotes the integration of communications technologies in all facets of education and training. The overall goals are to enhance quality and effectiveness, to increase access and flexibility, and to prepare learners to participate fully in a society increasingly dependent on global development and sharing of knowledge.

The Multimedia Program Development and Support Fund is a key component of the Strategy. It is designed to assist the universities and SIAST in developing new multi-mode approaches to teaching and learning that will accommodate the diverse needs of learners, both on-campus and in alternate settings such as home communities or the workplace. The Fund also emphasizes collaboration among the province's education and training providers, government, and the private sector in the development and delivery of innovative technology-enhanced learning resources.

Since its inception in 1995, the Fund has supported some fifty projects to develop courseware, learning support services and instructional strategies in the K-12 and post-secondary education and training sectors. These range from interactive CD-ROM and Internet Web-based resources to full courses designed in multiple formats. Below is a summary of programs and services being developed in the post-secondary sector or in partnership with K-12 educators.

1.1 SIAST

Navstar Global Positioning System (GPS) — Woodland Campus: Learning resources in multiple formats, including CD-ROM, Internet/Web-based and computer conferencing, and file transfer; for industry-based training.
URL: **http://www.siast.sk.ca/~woodland/dos/ind_res/irm/index.htm**

Early Childhood Development — Woodland Campus: Course materials adapted for new delivery modes, including Internet, e-mail and computer conferencing; suitable for access in rural and northern communities; credit is applicable in both K-12 and SIAST programs, and the new models can be adapted for other programs.
URL: **http://www.siast.sk.ca/~woodland/dos/bus_comm/earchild/index.html**

Online Testing System for Distance Education — Woodland Campus: Development of a secure online testing system for distance education, using graphics, audio, video and text formats; suitable for all levels of education and training both on-campus and in alternate settings; designed to meet provincial, national and global industry standards.
URL: **http://www.siast.sk.ca:3507/webtestr/owa/html_test**

Information Systems I — Palliser Campus: Adaptation of televised Business Certificate course to multiple formats, including CD-ROM, video, Internet, e-mail, print, and diskette; to augment existing televised and off-campus instruction for learners in remote communities and work sites.
URL: **http://www.siast.sk.ca/~comp120**

Multimedia Curriculum, Practical and Applied Arts — Woodland Campus: A new model for curriculum development, using technologies such as computers, teleconferencing, fax, e-mail and the Internet to support ongoing communication with partners in designing locally developed courses, databases, training, and curriculum guides; developed in partnership with Saskatchewan Education, Saskatchewan School Trustees Association, Saskatchewan Teachers Federation, League of Education Administrators of Saskatchewan, the universities, high schools, Regional Colleges and Saskatchewan Economic and Cooperative Development, in consultation with Alberta Education officials.

Computer-Mediated Academic Preparation for Science — Woodland and Wascana Campuses: Interactive, culturally sensitive science learning materials in various computer formats, including Internet, local networks, CD-ROM, videotape and print, with online testing capability, for bridging Basic Education 10 to Adult 12; suitable for learners in independent or group settings; developed in partnership with Regional Colleges, Saskatchewan Indian Institute

of Technology (SIIT), and Saskatchewan Indian Federated College (SIFC).
URL: **http://www.siast.sk.ca/~science/welcome.htm**

Parts Management Level I Partsperson Apprenticeship — Kelsey Campus: Redesign of course materials and exams in multiple formats, including audio, video, and computer-mediated, CD-ROM and Internet/Web-based modules for independent study or access at local schools, regional colleges or the workplace; supplements existing on-campus or off-campus instruction to enable apprentices to continue working while upgrading their credentials; also helps to address critical shortage of instructors; piloted with six students with modem dial-up or diskettes at off-site locations.

Entrepreneurship and Small Business — Woodland Campus: Adaptation of core components of the program to multiple formats for access on site in rural and northern communities, as well as on-campus, in partnership with local business and industry community.

1.2 University of Regina

Internet Tools for Teachers: Online Web-based resources for teachers using the Internet; available to education and training professionals across the province and beyond.
URL: **http://tdi.uregina.ca/~itt/**

Undergraduate Special Education: Computer-mediated communication components to diversify and supplement existing distance delivery using satellite and off-campus visits.

Distance Education Engineering Lab Instruction: Online computer-mediated undergraduate and graduate lab instruction at a distance, in cooperation with the University of Saskatchewan using the high speed Western University Research Network (WURCNET); sponsored by the Canadian Advanced Network for Research, Industry and Education (CANARIE).

Training Trainers and Learner Support for FirstClass: Development of modules, using computer-mediated communication and multiple formats, for training in use of common platform software for instruction, in cooperation with University of Saskatchewan.

Computer Literacy Repository: Adaptation of introductory computer science course materials into modules for online instruction in the classroom, at home or work-based settings.
URL: **http://tdi.uregina.ca/~complit/**

Math Central: Internet/Web-based math resources, including a database, a chat line for teachers and interns, and a Q&A site for learners, teachers and parents; linked with SIFC and University of Saskatchewan Math Readiness.
URL: **http://mathcentral.uregina.ca**

Risk Assessment and Management: Computer-mediated and audiographics resources for industry-based training, to be delivered through SIAST Kelsey and Woodland Campuses.

Technology-Assisted Adult and Continuing Education: Development of interactive computer, teleconference and audioconference course modules for this new Certificate in Adult and Continuing Education (CACE Western consortium) program, in cooperation with University of Saskatchewan; applicable to K-12 and post-secondary and training, primarily SIAST.

Math Readiness, Basic Education and Post-Secondary Multimedia Aids: Math upgrading materials in multiple formats, providing Aboriginal cultural context for northern and rural community university programs, with support for instructors; developed in cooperation with Tribal Councils, education authorities, university math departments, SIAST (ABE/Adult 12), and SIIT, and linked with MathCentral and University of Saskatchewan Math Readiness programs.

English Readiness — SIFC: Interactive Internet/Web-based pre-university tutorials in reading, writing and analytical skills for university-level study of literature; includes substantial works by First Nations authors and is available to learners throughout province, especially remote communities.

Saskatchewan Online: Electronic atlas of Saskatchewan on residents, cultures, natural resources, attractions, geography, issues, historical and current affairs about communities; developed in cooperation with K-12 students and teachers across the province.

Environmental and Earth Science (Geography): Interactive CD-ROM, online and e-mail adaptation of three physical geography courses for local and distance access, using existing and new materials (graphics, text, films, maps and field trip records); link to electronic environmental data, databases, technical journals, and archives of maps and satellite images.

Computer Science Enhancements for Off-Campus/Distance Learning: Interactive CD-ROM and web-based course and lab materials for teaching computer software applications off-campus; applicable to secondary and post-secondary levels.

Biology 100 Multimedia Laboratory: Interactive CD-ROM lab materials with still images, movie clips, text, exercises, tests, and manual to supplement an existing televised, off-campus and on-campus biology course.

Introduction to Social Work and Human Service Organizations — with SIFC: Entry-level core and optional course modules of community-based social work programs using teleconferencing, audioconferencing, computer-mediated and audio/visual aids, as well as on-site workshops and tutorials, for province-wide access.

Tools and Techniques for Engineering Courseware Modules: Templates for conversion of course materials to alternative formats, including interactive CD-ROM, Internet/Web, animation and live video; part of an overall plan to deliver first year engineering off-campus and at a distance and a full engineering program in cooperation with other universities by 2000; applicable to non-degree and work-based training.

1.3 University of Saskatchewan

Farm Enterprise Planning: Computer and Internet-based materials to supplement a correspondence course for the Agriculture Certificate Program (CAP), a prairie consortium; developed in cooperation with Farm Business and Agriculture Institute, service groups, Tri-Provincial Farm Business Management Group, and SIAST.

Common CMC/File Transfer Platform — FirstClass: Development of common software protocol for exchange of materials for distance education, using computer-mediated communication; developed with University of Regina and SIAST.

Math Readiness for Science and Engineering: Interactive, dynamic online, videotape and computer-mediated modules for pre-calculus algebra and geo-trig preparation for university science and engineering; students control manipulation of content; piloted with students across the province, primarily Key Lake and CAMECO mine employees; will be licensed for other universities and be available to high schools, especially band schools in the North, to supplement summer math camps; linked with SIFC Math Readiness and University of Regina MathCentral.
URL: **http://math.usask.ca/mrc**

Distance Education: Tools & Strategies: Undergraduate credit and non-credit course modules for teachers at a distance, using Internet, CD-ROM and video/audioconference technology; linked with Saskatchewan Teacher Education Network (STEN), and University of Regina's Internet Tools for Teachers; offered as a Web-based course jointly by the two universities in Winter 1998.
URL: **http://www.usask.ca/DLC**

Administration of Small and Rural Schools: Fully-integrated online graduate course for delivery using the Internet/Web throughout Saskatchewan and Canada to educators at home or work sites, in cooperation with SSTA; augments flexible weekend delivery.

Electronic Off-Campus Library Services: Online interactive bibliographic search, orientation, and reference services for distance learners at institutions, off-campus or home, using electronic conference, graphics, audio/video and file transfer technologies; developed in cooperation with University of Regina, SIAST, regional colleges, St. Peter's College, NORTEP/SUNTEP; K-12 schools and provincial and regional libraries.
URL: **http://library.usask.ca/remote.html**

MicroWeb ToolKit: Software interface for instructors to locate Web-based resources by topic and concepts, control access, and track student Internet activity; piloted in university community, and applicable for access by novice users of all ages, levels, subjects and locations.
URL: **http://www.cs.usask.ca/grads/jrt128/webnet.html**

Phonemes for Teaching English as a Second Language (CERTESL): Interactive electronic tools, incorporating graphics and sound, for training teachers of ESL; part of an interprovincial and international program and applicable to aboriginal teachers; designed for multiple platforms, including computer diskette, DOS, Macintosh and IBM.

Saskatchewan Interactive: Extensive multi-mode graphics, sound and video materials for interactive CD-ROM and Internet-based instruction, covering six Saskatchewan resource sectors — agriculture, forestry, mining, fishing, tourism and the environment; suitable for K-12 education, skill development and work-based training resources; includes an electronic resource locator, manuals, lesson plans, tests and virtual reality; requires high bandwidth for access; developed by the College of Agriculture in cooperation with GlobalEd Media, Saskatchewan Education, Correspondence School, federal and provincial governments, Wanuskewin, private sector companies, and schools.
URL: **http://interactive.usask.ca**

International Trade and Saskatchewan Students: Internet/Web-based resources for self-study and high school level cooperative learning; includes teacher in-service and resource kits on international agriculture trade policy, law and economics, and links to federal departments; university law and agriculture colleges.
URL: **http://cru.usask.ca.Trade**

Online Political Studies 110.6: Integrated interactive online Web-based materials to complement televised and classroom-based instruction, using computer-based text, links to Internet/WWW resources, audio and video materials and computer conferencing.

Clinical Gross Anatomy — Head and Neck and Thorax Modules: Computer-based, 3D interactive tutorial modules, with animation; case studies, to enhance lecture and laboratory teaching and enable students to manipulate anatomical objects, explore clinical problems, and evaluate their learning independently.

Chest Assessment Module for Physical Therapy: Interactive CD-ROM and print resources for self-study for physical therapists and respiratory health professionals in cardiopulmonary clinical practice; serves as a prototype for future related case-study modules to be converted to distance learning; developed in cooperation with Dalhousie University.

2 Changing Directions in Training, Education and Labour Market Services Using Innovative Technologies

(Excerpt from a work in progress.)

The use of information technology has become a priority for most new developments in training, education and labour market services. Information technologies will increasingly stand at the heart of transformations in these areas. Digital technology offers significant opportunities to advance the quality and accessibility of the training experience for both providers and learners. The challenge offered is how best to use this changing technology to enhance adult training rather than relying on technology to drive the innovations to which adult training must then adapt.

Learning and working in a wired, networked world represents a social shift that is reordering our lives far more substantially than any mere hardware or software ever could. The effectiveness of the training strategy will, to a large extent, be dependent on the success of not just integrating technologies but also integrating a "networked mentality" into the Training Strategy.

With the massive changes occurring in work and training, a strategic direction incorporating the articulated values and principles becomes essential. The debate regarding extensive use of technology is long over. The operative word now is "how" — how to integrate innovative technologies in a manner that supports and enhances the goals of the Training Strategy rather than detracting from its goals.

To further the objectives of the training strategy the following goals are proposed:

- using technology to move to a new training, education and labour market services model,
- using technology to improve access and cost-effectiveness,
- using technology to improve success outcomes,
- building partnerships and clarifying roles for more effective sharing of technology and its applications, and
- building a learning technology model that is continually regenerated.

As these goals are pursued, there will be the need to constantly monitor the external environment in order to determine where technology and its applications are taking adult training and how the department needs to adapt to deliver its mandate effectively. At the same time the department can facilitate and, in some areas, lead improvements in adult training based on the Saskatchewan experience and expertise. The most appropriate technologies can be adopted to drive such improvements.

2.1 Goals

2.1.1 Using technology to move to a new training, education and labour market services model.

Educators are caught in an environment of change that they are not currently leading. Although technology is driving much of the change, the sociological changes that it is bringing are difficult to plan for at this stage. "What appears to be a discussion about technology is, in reality, a discussion about curriculum." "If educators do not define the educational uses of information technology, others will." (both quotes from James S. Noblitt, 1997). With the Training Strategy, Saskatchewan has the opportunity to build on the strategic advantages of technology in making needed changes to its training, education and labour market services system.

The transformation can be described as follows:

Moving From:	To:
Institutional learning	Anytime/anyplace expectations
Few job changes	Careers consisting of multiple and simultaneous commitments with constant new skills
Career planning by experts, mostly to targeted groups	Self-responsibility/all workers
Limited access to LMI	Public expectations for quality LMI
Post-secondary learners young adults	Over half the learners now adults over 18-22
Delivery by lecture/credit for contact	Communications infrastructure (campus, network, national infrastructure)
Local libraries	World-wide libraries (freed from time and place)
Limited responsiveness to learning styles	Teaching/training responsive to multiplicity of cognitive styles
One method fits all	Customized service directly to learner
Single professor approach	Teaching/training more of a team effort (course content specialists, delivery experts, and instructional designers)
Traditions and long-standing techniques	Experimentation/no one model likely to dominate
Institutions as centers of experts	Learner and community accountability
Limited range of computer-based	Proliferation-exciting work in computer-based instruction emerging across a broad range
Instructional material	Curricular base
Institutional separateness	Seamless access to a broad range of information resources, in a variety of media, across diverse technical platforms and institutional boundaries
Education suffering from competition	Renaissance of education - training/education pivotal to strong economic growth for public dollars
Teaching of skills/knowledge	Teaching how to learn, how to decipher information and how to know what need to learn next
Manageable change/growth	Power of computer chips doubling every 18 months (can offer new learning options, also greater challenges to change and adapt)
High costs of technology	Cost of digital technology at chip level decreasing at better than 25% per year for last decade (cost of computer same as slide rule 25 years ago) (allows for more inclusive use of technology)

2.1.2 Using technology to improve access and cost-effectiveness.

Access and cost-effectiveness become more important for the learning system as learners expect access to an expanded array of programs, to life-long learning, and to remote access, and further as society attempts to bring learners with significant barriers into the training system.

Virtual campuses, online programs, chat lines, electronic access to libraries, CD-ROMs, and other tools can provide opportunities to enrich the training experience. For some trainees, such as people with certain disabilities or home restricted single parents, these tools will provide opportunities previously denied them. The challenge is to ensure that technology is used to improve access to learning and not create a further division between those with access to technology and those without. Special initiatives are required to ensure access for learners on low income.

Appropriate use of technology can assist in:

- improving the cost-effectiveness of programs: while costs will not be reduced in the short-term until infrastructure and hardware needs are met, training can be more cost-effective if institutions specialize and share knowledge and resources;
- ensuring adult learners anywhere in the province have access to quality training and LMI services; and
- connecting Saskatchewan learners to experts around the world, through Internet, CD-ROMs, Library access.

2.1.3 Using technology to improve success outcomes.

An accountability framework is being developed under the Training Strategy that recognizes that learners, parents, government and the community are expecting stronger measures for determining program outcomes. Appropriate use of technology can assist in:

- facilitating higher completion rates: responsiveness to learning styles, easier access, clearer and consistent teaching guides, graphics interfaces, speech and hearing accommodations;
- facilitating higher completion rates for equity groups;
- speeding up completion times: online and modular learning allow students to work at their own pace and focus on gaining competency, rather than the length of a program;
- building confidence of learners: many adult learners have difficulty in group interactions, and appropriate technology can provide remedial help without exposing the learner;
- setting up opportunities for continued success: learners become comfortable with self-directed and computer based learning, which will be the increasing direction of the future.
- facilitating accommodation for special needs while promoting inclusiveness: through sharing of expertise, different institutions can offer specialized programming, which allows adult trainees to benefit from programs taken with broader group.

2.1.4 Building partnerships and clarifying roles for more effective sharing of technology.

Through the Training Strategy, the Strategic Initiatives, and Job Start/Future Skills, the Department can play an important role in facilitating partnerships to further the appropriate use of learning technologies. Saskatchewan has a long history of using technology to improve administrative functions and offer distance education programs. Attention is now turning to improvements in technologies and work-placed delivery. Development costs, both financial and human resources, and the need for integrity of content point to new partnerships within professional sectors, including the Saskatchewan Labour Force Development Board, the private sector, institution (SIAST), and departments.

Partnerships to develop specific initiatives could include work related to:

- identifying and developing areas for export of Saskatchewan training content, including life skills and bridging programs;
- key sectors lending themselves to computer-assisted learning, both in apprenticeship programs and other work-based programs;
- building on or using technology innovations begun in Strategic Initiatives to improve training;
- improving Saskatchewan's level of literacy through enhanced work-place literacy programs;
- improving participation of equity groups in employment in the information technology sector.

2.1.5 Building a learning technology model that is continually regenerated.

To ensure that programs and services continue to be relevant there is a need for:

- a mechanism for tracking, monitoring and sharing trends in training and in the use of learning technologies.

2.2 Current and Emerging Projects and Programs

Below is a list of projects currently underway or being planned, using technology to enhance learning and services that pertain specifically to the Training Strategy. Several of these have received funding from the PSEST Multimedia Program Development and Support Fund (MPD&S). For a complete list of projects supported under the Fund to date, refer to Section 1.

2.2.1 Learning Enhancements

Work/Study Strategic Initiatives

Entrepreneurship Training in Tourism Industry: The Saskatchewan Tourism Education Council, in partnership with Tourism Saskatchewan, SIAST Woodland Campus and the Business Development Bank of Canada, will deliver entepreneurship training to twenty small tourism operators combining classroom, home study and multi-media approaches. Materials and instructional strategies in various modes are being developed through the MPD&S Fund.

Automotive Service Technician Apprenticeship Training: SIAST Kelsey Campus, in partnership with the Apprenticeship and Trade Certification Unit and journeypersons and employers in the automotive industry, is coordinating work-based competency training combined with institutional training to assist seven Automotive Service Technician apprentices to achieve Level One Apprenticeship credit. In addition to work-site delivery, in-home learning via the Internet is being tested.

New Media/Adaptive Systems Project: Pebble Beach Interactive Inc., in partnership with SIAST Wascana Campus, HRDC and the media industry, developed curriculum and a certification process for training New Media Specialists in emerging technology in new media/adaptive systems. A team of eight specialists were trained to source, evaluate and incorporate the latest technology and software in multimedia production. The training program was developed with funding through Job Start/Future Skills.

Electrician Apprenticeship Training: SIAST Palliser Campus, with the Apprenticeship and Trade Certification Unit, Electrician Level One apprentices and employers/contractors, have partnered to test a new way of meeting skill development needs in the electrical industry. Existing curriculum is being redesigned into independent modules, incorporating audio/video, distance delivery, printed materials and learning guides, and is being delivered to twelve apprentices.

Community Economic Development Remote Delivery: Northeast Economic Development Corporation, in partnership with the Peter Ballantyne Cree Nation, Cumberland House Cree Nation, NCC, Future Skills, SIAST Woodland Campus, SaskTel, Northlands College and the villages of Sandy Bay, Pelican Narrows and Cumberland House, will test the delivery of Community Economic Development training to ten trainees in northern communities using Internet technology combined with teleconferencing and mentor support.

Study and Work: This Prince Albert project will develop an labour exchange website that will store employers' and students' profiles in an interactive format, to provide student with access to information on jobs. Partners include the Prince Albert School Division No.3, Kinistino School Division, Prince Albert Separate School Division, Carlton Comprehensive High School Board, Prince Albert Rural School Division, Human Resources Development Canada, Prince Albert Chamber of Commerce and SIAST Woodland Campus.

Information Technology Competency Framework: The Software Technology Centre, in partnership with the City of Regina, SaskEnergy, Farm Credit Corporation, SaskPower, Saskatchewan Wheat Pool, Saskatchewan Workers' Compensation Board, Saskatchewan Property Management Corporation, Wascana Energy, SaskTel, SGI, Fontaine Associates Consulting Services and the University of Regina Vocational Technical Education Department, will develop and validate an Information Technology Competency Framework depicting the IT competencies Saskatchewan needs to be globally competitive.

South West Centre for Entrepreneurial Development Inc. (SWCED): SWCED will partner with Nikaneet First Nations, City of Swift Current, Swift Current Comprehensive High School, Southwest Chapter of Women Entrepreneurs, Town of Maple Creek, Human Resources Canada, Office Outfitters, Quest Management Inc., South West Community Futures Development Corporation, and NCC, to develop, deliver and test the effectiveness of delivering unique entrepreneurial training using CU-SEEME technology and innovative "hands on" teaching techniques.

SIAST Initiatives

Multimedia Academic Preparation for Science Programs (Funding from MPDS, with an evaluation component funded by the Office of Learning Technologies): SIAST Woodland

Campus, in partnership with Northlands and Parkland Regional Colleges, SIIT, SIFC and Wascana Campus is designing this program in multiple modes to help prepare individuals for studies in the sciences (biology, chemistry and physics). It integrates scientific and Aboriginal perspectives to help increase the interest of Aboriginal adults in science. The program can be offered at a distance using Internet, videotapes, and CD-ROM technology.

CD-ROM Introductory Math Program (Funding from National Literacy Secretariat): SIAST Woodland Campus has received funding to develop an interactive CD-ROM that will help low literacy adults in numeracy skills. It will be a step by step approach to math with easy learning and addressing special learning needs.

Multimedia Communications Program (Funding from SaskTel): SIAST Wascana and Woodland Campus have developed a new multimedia communications program, focussing on communications and production from an artistic, business and technical perspective. SIAST is currently working on a partnership proposal with the University of Regina Film Department to develop a joint program where students would complete the theory at the University and their practicum at SIAST. SIAST has formed an Advisory Committee made up of representatives of the media industry.

Virtual SIAST Campus: SIAST is in the process of setting up a "virtual" campus. Research has included interviews with Athabasca University, Okanagan University, University of British Columbia, Open Learning Agency in B.C., Memorial University of Newfoundland, Consortium of Northern Colleges (Alberta North), and New Brunswick Department of Advanced Education TeleCampus.

Digital Curriculum Project: The goal of the Digital Curriculum Project is to develop an integrated interactive and responsive curriculum database characterized by a range of flexible delivery modes. It will support distance learners more effectively, enable instructors to revise and update curriculum quickly and customize it to learner needs, using print, CD-ROM, computer disk, online or Web delivery, and provide interactive links to multimedia resources. The Learning Manager, a PC Windows-based software application, was the catalyst for project development.

Work Keys: SIAST has adopted Work Keys, a competency-based software program for management and development of Human Resources, distributed by the Association of Canadian Community Colleges. The program has three major components: job profiling to assess skills required for specific jobs, assessment of existing skills, and training that can be customized to meet employers' needs. It assesses skills that are common to a variety of jobs, including applied math, applied technology, reading for information, teamwork, speaking, locating information, writing, observation and listening. Students or employees learn their strengths and weaknesses and the skills needed to prepare for specific jobs. Assessments give a standing specifically related to the requirements of the job, rather than comparison with peers.

Institutions can use Work Keys to design and offer courses that meet the needs of the workplace, in partnership with industry. Students or employees who lack the necessary academic qualifications for the program can use the Plato software program to address basic skill gaps.

Recreation and Leisure: This was the first program in the Health, Sciences and Community Services Division at SIAST Kelsey Campus, to establish a web page. Research is underway to determine the feasibility of delivering the entire two year program on the Internet.

Recreation Therapy: At SIAST Kelsey Campus, curriculum is being developed in modules, to allow for delivery either through the Internet or satellite television.

Medical Diagnostic Technician: Four colleges, including SIAST Kelsey Campus, in the three prairie provinces have been involved in an Interprovincial Curriculum Redesign Project, redesigning curriculum for Medical Laboratory Technology, Medical Radiation Technology and Combined Lab and X-ray Technology. This redesign allows for laddering programs and enhancing options for cross-training and lifelong learning with connections to 15 universities in Western Canada and the United States. The programs are being redesigned in modules to provide flexibility in delivery options, including the possibility of Internet delivery.

Finding the Balance — Environmental and Ecological Issues on a Global Scale: This interactive learning resource explores our planet, examining the consequences of environment and ecological management, using the Seychelles Islands to demonstrate the ecosystem. Developed by SIAST International, Pebble Beach Interactive and Softwaves Educational Software of St. John's, Newfoundland, it is Saskatchewan's first international educational CD-ROM.

2.2.2 Service Enhancements

Career Services Strategic Initiatives

Funding of about $3 million has been allocated over two years under the Canada-Saskatchewan Strategic Initiatives program to test new community-based models for delivery of career services. This program uses multi-media technologies to provide clients with up-to-date information on self-assessment, education and training, and career exploration. Three pilot projects are currently underway in Northern Saskatchewan, Regina and Rural Saskatchewan, as follows:

North-Keewatin Career Development Corporation: This northern Saskatchewan partnership is developing and implementing comprehensive online career counselling and assessment processes to meet the specific needs of northern residents. It provides an electronic network of career counsellors in northern communities, in partnership with more than 30 northern centres, including several Metis Pathways and First Nations centres, Dumont Technical Campus, Northlands College and northern school divisions. An Internet web site is being developed that will provide a database of counsellors, job listings and education and training opportunities, at URL: **http://www.max.sasknet.sk.ca/kcdc** (temporary), soon to be **http://www.kcdc.sk.ca**.

Regina Career Linx: This group is developing online labour market, career counselling and assessment services for the Regina region, in partnership with HRDC, NCC and SIAST Wascana Campus. A testing and training centre and community network has been established, which will use e-mail, discussion groups, videoconferencing, CD-ROMs, and other information technologies, as well as services for clients with special needs. An Internet web site is being developed at URL: **http://www.careerlinx.regina.sk.ca**, currently providing information for work seekers, employers and job matching.

Rural Saskatchewan: This project, through the collaboration of seven regional colleges, HRDC, Saskatchewan Association of Community Networks, and local Regional Economic Development Authorities, is examining new approaches for providing career services to rural Saskatchewan, using multimedia technology such as videoconferencing, audioconferencing, CD-ROM, and instructional software. A "multimedia career resource centre" will be established in each of the seven regions and will house career counselling resources in print and electronic formats suitable for rural residents. An Internet Web site is being developed, to provide a career services directory, links to other career services sites, e-mail, chatlines and bulletin boards for practitioners, job seekers and employers.

NCC Career Planning Web Site (in PSEST Web Site): This site provides career planning information, assessment tools and extensive links to other career and labour market information. With funding from the Office of Learning Technologies, SIAST Woodland Campus is evaluating the site, in cooperation with approximately 75 adult clients with low levels of education.

Labour Market Information (LMI) Strategic Initiatives

A variety of projects under the LMI will substantially upgrade the quality of information available to students, employees and employers. The majority of the information from the LMI projects will be available either on the Partnership Web site or the Department's Extranet network. The Partnership Web Site-Joint LMI/Career Services, with the accompanying Extranet site is an electronic single access point for communicating and distributing career, employment and labour market information. Projects include: Strategic Initiatives Forecast, Partnership Access to the National Labour Market Information System, Saskatchewan Sectors Study, First Nations Client Tracking System, Metis Employment Strategies, Wide-Area Network, Geographic Area Files, Saskatchewan Job Futures, Frequently Asked Questions on the Labour Standards Act and Occupational Health and Safety Act, Saskatchewan Wage and Salary Survey, Union Wage Database, Training Outcomes-SIAST Graduate Employment Statistics, Skill Profiles for Tourism Occupations, Education and Labour Market Mobility, and Saskatchewan Labour Market Review.

New Income Support Programs

The Provincial Training Allowance provides living allowance for clients enrolled in basic education, short skills courses and related courses. The Provincial Youth Allowance provides financial assistance to youth participating in the Youth Futures pilot project in Prince Albert. Information on student loans, as well as information on available training, will be available on the PSEST web site.

JobStart/Future Skills

Sector agreements have been signed with the Apparel and Textile Industry, the Tourism Industry and the Trucking Industry to identify training needs and offer alternative approaches for delivery of training. Numerous projects to retrain workers for new technology have been approved. Information on JobStart/Future Skills is available on the PSEST web site.

Complementary Projects

Net-based Math Readiness Course Trial (MRC), University of Saskatchewan: This program is intended to bridge the gap for adult learners between the mathematics skill they have acquired and retained from high school and the knowledge and skills that are expected in post-secondary education programs with a significant quantitative component. It includes a summer camp on campus, and a print package, as well as an online component developed through the Multimedia Program Development and Support Fund. SaskTel and a northern mining company are also sponsoring the program to serve northern residents. Recently, the Office of Learning Technologies provided funding to evaluate the program through a trial involving home-based, school-based and work-based learners in northern and remote communities.

Model Network for University Learning in First Nation Communities: The Saskatchewan Indian Federated College has received funding from the Office of Learning Technologies to establish a learning network among First Nation communities in Saskatchewan. This pilot project will test the effectiveness of a variety of learning technologies — computer-mediated communication, teleconferencing and others — to deliver community-based university courses to adult learners in Meadow Lake, Prince Albert, Lac LaRonge and Wollaston Lake.
The technology will link students with instructors and other learners at the Regina and Saskatoon campuses of SIFC.

Older Adults and Learning Technologies: The University of Regina Seniors Education Centre has received funding from the Office of Learning Technologies for this two-phase project to develop an electronic network to meet the learning needs of adults 55 years of age and older and provide access to technology-based learning opportunities adapted to their needs.

Women's Access Project: The Saskatchewan Women's Secretariat is launching an initiative to enhance women's access to new communications technology. Through this project, organizations may be eligible to receive training, technical support and equipment grants to facilitate access and use of the Internet. Community women's organizations are being consulted in developing the framework for the project.

2.3 Noteworthy Practices

It is difficult to clearly identify "best practices" when describing innovative technologies in training, education and labour market services. What worked a couple of years ago may no longer be relevant in planning changes over the next couple of years. Again, the balance among external circumstances, changes in technology, and the needs for adult learners in this province must be weighed against what appears innovative in another jurisdiction.

Defining what is a best practice can be suspect at this time since many of the innovations are in their early stages and have not yet been subjected to evaluation in terms of impact on learning by students or productivity improvements in institutions or at the work site. In addition, because of the broad scope of the training strategy, it is difficult to find exact parallels in other jurisdictions. At the same time, important learning can occur from awareness of innovative projects and processes that have been used elsewhere. Thus, the following section of "noteworthy practices" offers some samples of innovative projects and processes that have relevancy to the training strategy.

2.3.1 Strategic Planning Processes Building New Alliances

British Columbia — Charting a New Course

In 1996, British Columbia, created the Centre for Curriculum, Transfer and Technology. The Centre's role is that of a catalyst for change in post-secondary education in B.C., with an emphasis on promoting the learning outcomes approach and encouraging and supporting increased use of educational technologies. The Centre is also charged with seeking ways of improving learner transitions into and through the post-secondary system, and from the system into the workplace. It also manages Provincial curriculum development projects.

The Centre is a non-profit society governed by a Board (appointed by the Ministry of Education, Skills and Training) consisting of representatives of the various groups which participated in the strategic planning process, including faculty and administrative groups, students and support staff, and Ministry representatives. (The strategic plan has been developed to ensure that all British Columbians are prepared to participate in today's changing society. The plan was the result of collaboration between the Ministry of Education, Skills and Training and organizations in the college, institute and agency systems, working through a provincial steering committee composed of institutional presidents, board members, faculty, students and government representatives.)

The goal of the Centre is to have the learning outcomes approach become standard. This approach sees the first consideration as the overall educational needs of learners. This involves consultation on needs with the larger community, emphasizing general education and generic skills which provide the ability to undertake a lifetime of learning and which allow for the adaptability necessary to respond effectively to a changing society. It also involves exploring improved means of making curriculum accessible to more learners and the consideration of how best to undertake student assessment.

In describing their best practices, the focus is on the impact on learners, the institution and the wider community.

B.C. has a history of involvement with innovative technology through its Commonwealth of Learning and its Open Learning Agency (now a virtual university). It has two additional virtual campuses, the Okanagan University and the University of British Columbia. A number of innovative and diversified projects have received funding from the Office of Learning Technologies.

Arizona Learning Systems — Transforming Higher Education through Technology-Assisted Learning

Arizona Learning Systems is an alliance of Arizona's urban and rural community colleges whose purpose is to provide learner-centered educational environments that build on the unique advantages technology affords the learning process.

It is governed by member colleges and functions as a virtual branch campus with limited staff. Students maintain their institutional affiliation with the local campus. Additional partners in the delivery strategy include public schools (K-12) and Arizona's universities, including the Western Governors' Virtual University. The primary purposes of Arizona Learning System are: the expansion and upgrade of telecommunications infrastructure to connect over 155 learning sites across the state through a contract with a private vendor; the redesign of a segment of higher education delivery to meet the changing needs of Arizona's residents for user-convenient access to an expanded array of programs and continuing education; and the development, application, and assessment of new and powerful technology-assisted learning strategies.

One of the unique features of ALS is its acknowledgement of the importance of local colleges and their connection to the community. It has built a community of interest among the colleges, providing a forum for sharing of technical information, discussion of the evaluation of learning strategies, and mutual support for experimentation and risk-taking.

ALS focuses first on desired learner impacts, second on how this can be supported with new applications of technology, and last on the hardware and software. It promotes the transformation of instructional practices through established standards. These standards focus on learning outcomes rather than on the process of delivery. Rather than "digitizing the classroom," ALS attempts to build on the strategic advantages of the technology.

In terms of faculty development, ALS recommends that faculty courseware developers work with technical assistants or a multimedia specialist who takes the faculty member's product and refines it to produce high quality, visually aesthetic and stimulating courseware.

2.3.2 Infrastructure Standards

A commitment to better adult learning practices through innovative technologies is difficult to demonstrate without a strong commitment to infrastructure and training.

Access to the Internet

ZDNet, with advice from Kenneth Green, director of the annual Campus Computing Survey, rated U.S. universities and colleges as to which schools provided the most access and exposure to the Internet. The criteria used to determine the rank might be a useful tool for assessing the state of SIAST's degree of "wiring."

Of the 100 most wired colleges (1996):

- 100% offer students access to online library catalogs
- 99% offer students unlimited WWW access
- 98% offer students a default e-mail account
- 87% offer students Web space for a home page
- 85% host a campus-based newsgroup hierarchy
- 71% supply a port for every pillow (computer ports per student)
- 43% allow students to view their transcripts online
- 29% allow students to register for classes online
- 28% allow students to add/drop classes online

- 11% require Internet training
- 3% supply every student with a PC

The survey also rated the percentage of academic courses likely to have a Web page at any given time, whether students could submit homework online, and whether courses had study questions or notes online. Academics accounted for 45% of the total score, hardware/wiring and social use comprised 22.5% each with student services accounting for 10%. The differences in scores between the highest and lowest scores within the top 25 schools were slight. For example, between Emerson and Stanford, Emerson's higher rates were because of new use in academics. 70% of courses were reported to use Web resources in teaching, and more than half have a home page and/or allow students to submit homework and get class notes online.

Campus Computing Project

In the 1996 Campus Computing Project, of the 660 institutional respondents:

- just over one-fourth (27.3%) identified that assisting faculty integrate technology into instruction was going to be the "single most important" information technology issue at their institution in the coming years
- another fourth (24.1%) reported that "providing adequate user support" was the top technology challenge confronting their campus
- less than half (43.4%) reported having a strategic plan that describes institutional goals, objectives, or implementation priorities for the role of information technology
- just over one-fourth (28.1%) report a budget model for amortizing and routinely replacing computers and software — the data showed that "more than a decade into what some have called the 'computer revolution' in higher education, it is very clear that most campuses are still operating without a strategic or financial plan for information technology."
- two-thirds (67.0%) of all undergraduates have access to e-mail and the Internet, up from 60% in 1995.

2.3.3 Specific Innovative Projects

Office of Learning Technologies

The Office of Learning Technologies (Human Resources Development Canada) provides grants to partners to expand innovative learning opportunities for Canadians through the use of learning technologies. The OLT has established an Advisory Network of Experts, consisting of members from the academic community, private sector, public sector, and non-government organizations. This advisory network provides quality information and advice related to learning technologies.

There is a wide diversity of projects supported and they are in different stages of development. In addition to such projects as Learning Through New Technologies: Response of Adult Learners, Adapting Trades Upgrading Training for Distance Delivery, Distance Prior Learning Assessment Project, Testing a Learning Model for People with Disabilities, Evaluation of Computer-assisted Learning for Adult Basic Education, there are also several projects that are evaluating the effectiveness of learning technologies. These will be tracked to obtain relevant information for the Training Strategy.

Example from Health Sector — Kansas Primary Care Nurse Practitioner Program (Virtual Classroom)

This program is becoming a model for delivering basic health care in rural areas across the U.S. Four different nursing schools pooled their resources to make classes available to students all over Kansas via compressed video (a medium that digitizes both visual images and sound, then "compresses" the information for transmission over high-speed telephone lines to specially configured television sets). The quality is almost as good as satellite TV, at greatly reduced costs ($2,000 per hour versuss $30) and enables students and teachers to interact with only a slight, almost imperceptible lag. Since the transmission occurs over telephone lines, the cost of adding on to the network is relatively low. Instructors are also adapting their course work for the World Wide Web.

Almost 250 nurse practitioners have graduated. The compressed video allows for long-distance consultations with medical specialists. This aspect, plus the programs protocol allowing nurses certain prescription writing, is allowing two-thirds of them practice today in under-served rural areas. The University of Kansas medical school is looking closely at the program and hopes to use the compressed-video network launched by the nurses to allow future medical students from rural areas the opportunity to complete as much of their education as possible right where they live

2.3.4 Support for Graduates

First Job in Science and Technology

As part of the B.C. Guarantee for Youth Program, the B.C. government has invested $1.8 million in partnership with B.C. businesses to create over 150 first jobs in science and technology. This year the program will assist 200 graduates in science, technology or engineering to get their first full-time job.

Appendix C
Definition of Terms

Following is a *selected* glossary of terms commonly used in discussion of technologies for learning. It is intended for a lay audience.

Asynchronous transfer mode (ATM): a network technology based on transferring data in cells or packets of a small, fixed size. The small, fixed cell size enables ATM equipment to transmit video, audio and computer data over the same network while ensuring that no single type of data dominates the line. Current implementations of ATM support data transfer rates of 25 to 622 Mbps (megabits per second). This compares to a maximum of 100 Mbps for Ethernet, the technology used for most local area networks, and a maximum of 56 Kbps (kilobits per second) for data transfer over a standard Canadian telephone line. For some, ATM holds the answer to the Internet bandwidth problem of limited line capacity to transmit video, audio and data simultaneously, but others are skeptical. To begin the transfer of data, ATM creates a fixed channel, or route, between the source and destination. This differs from the standard Internet data transfer protocol known as TCP/IP, in which messages are divided into packets, and each packet can take a different route from source to destination. The difference makes it easier to track and bill data usage across an ATM network, but less adaptable to sudden surges in network traffic.

Asynchronous transmission: the transmission of data one character at a time with intervals of varying lengths between transmittals. Start and stop bits (or specifically coded computer programming) at the beginning and end of each character control the transmission.

Audioconferencing: a conference involving the transmission of voices and other audio only over telephone lines. The voices at each end of an audioconference are typically amplified by means of a speaker system.

Audiographics: the use of audioconferencing accompanied by the transmission of still pictures and graphics via slow-scan video, fax or an electronic graphics tablet.

Bandwith: the range of frequencies that an electronic communications channel can support without excessive deterioration. For example, one telephone line provides a low bandwith connection. With this type of connection, simple text-based data is easily transferred between computers. However, one telephone line does not effectively support the transfer of full-motion video; the video signal deteriorates. Full-motion video requires a high bandwith connection, such as that provided by ATM.

Bridge: a device, often leased through a telephone company, that links three or more telephone lines together for audioconferencing.

Broadband: a type of data transmission in which a single physical medium (such as a fibre optic cable) can carry several channels at once. Cable television, for example, uses broadband transmission.

Broadcast: to simultaneously send the same message to multiple recipients. The term is commonly used in reference to an open-circuit communications medium, such as television or radio, whose unscrambled signal is available to multiple recipients.

Cable television: a television distribution system consisting of a closed-circuit, usually wired, network for transmitting scrambled signals from an originating point to members of the network who have the equipment to receive, unscramble and view the signal. Typically, the originating point receives and retransmits broadcast programs and/or some live programs.

Channel: a communications path between two devices. It refers to either a physical medium (such as the cable), or to a set of properties, that distinguishes one path from another. For example, one property that distinguishes a television channel is the specific frequency at which it is transmitted.

Client/server application: a software program requiring a connection between the user's computer system and a host computer system. A client version of the software resides on the user's machine. The client version usually does not have any significant computing capabilities on its own. However, it does enable the user to connect by the Internet or a direct dial telephone call to the host computer system. The host computer system, or server, allocates resources for the network. The server version of the software resides on the host, and it possesses the full computing capabilities of the particular application. See "Network."

Communications satellite: a satellite specifically designed to transmit telephone, television and computer data. Data is collected by a terrestrial uplink site (or sites) that beams the signal up to the satellite. The satellite then redirects the data through its transponder to a terrestrial downlink or receiving site (or sites) that is specially equipped to receive and decode the signal. Communications satellites are usually placed in a geosynchronous orbit (meaning that they revolve at the same rate of speed as the earth) above the equator, and thus remain stationary with respect to the earth. The geosynchronous orbit enables sending and receiving antennas to be permanently aimed at the satellite.

Compressed video: video images that have been electronically processed to remove redundant information, thereby reducing the amount of bandwith required to transmit them. Because only changes in the images (such as the movement of a hand) are transmitted, movements appear jerky compared to full motion video.

Computer conferencing: a conference by which two or more participants exchange messages (usually text-based only) using personal computers that are connected to a central server through the Internet or a direct dial telephone line.

Computer-managed learning (CML): the use of a computer system to manage information about learning performance and learning resources in order to prescribe and control individual messages.

Computer-mediated communication (CMC): the use of a computer system as a device for enabling communication between the instructor and learners and among learners, often over distances. Electronic mail and computer conferencing are two types of application software commonly used in CMC.

Convergence: the merging of two or more disparate technologies or disciplines. For example, the facsimile (or fax) machine resulted from a convergence of telecommunications, optical scanning and printing technologies.

Courseware: a type of software designed for use in an educational program. It may also be known as "learnware."

Digital video: the capturing, manipulation and storage of video in digital formats. A digital video (DV) camcorder, for example, is a video camera that captures and stores images on a digital medium such as a digital audio tape (DAT). Digital video is easily integrated into computer applications.

Distance learning: a learning situation characterized by the physical separation of the learner(s) from the instructor. The learning process is typically facilitated by the use of technology to bridge the distance.

Electronic mail (e-mail): the transmission of messages over communications networks to an electronic address. The messages can be notes entered from the keyboard or electronic files stored on diskette. Some e-mail systems are confined to a single computer system or network (such as an Intranet), but others have paths to other computer systems (such as the Internet), enabling users to send electronic mail anywhere in the world. In recent years, the use of e-mail has exploded. By some estimates, there are now 25 million e-mail users sending 15 billion messages per year.

Electronic office: an office characterized by an electronic, rather than physical, connection to other offices. An electronic office is outfitted with such equipment as a computer (with an Internet or Intranet connection), printer, scanner, fax machine and telephone (with voice mail).

Fibre optic cable: a cable on which information is transmitted using modulated laser light along a plastic or glass fibre the thickness of a human hair. Fibre optic signals are immune to electro-magnetic interference, unlike signals in copper cable. Fibre optics are difficult (and expensive) to connect, but this makes it less vulnerable to tampering. As well as being cheaper to produce than copper cable, fibre optic cable can carry far higher volumes of information. Transmission speeds of over 400 Mbps (megabits per second) have been achieved on fibre optic cable. This is the equivalent of 200 million simultaneous telephone conversations, or transmitting the entire contents of Encyclopaedia Britannica in one second.

Footprint: the geographical area over which a communications satellite signal can be beamed down.

Firewall: a system designed to prevent unauthorized access to or from a private network such as an Intranet. A firewall can be implemented in both hardware and software, or a combination of both. It is frequently used to prevent access by unauthorized Internet users. All messages entering or leaving the Intranet pass through the firewall, which examines each message and blocks those that do not meet the specified security criteria.

FirstClass: a client/server software application specifically designed to support computer conferencing. It enables private messages between individuals via e-mail, asynchronous group discussions via conference areas, and live, synchronous chatting between two or more individuals. Comparable software applications include Lotus Notes and CoSy.

Groupware: a type of software that assists groups of colleagues (or workgroups) attached to a local-area network (LAN) in organizing their activities. Groupware typically supports the following operations: scheduling meetings and allocating resources; e-mail; password protection for documents; telephone utilities; and, electronic newsletters. Groupware is also known as "workgroup productivity" software. Current versions of Corel Office Suite, Lotus Office Suite and Microsoft Office have groupware capabilities.

Hypermedia: an extension to hypertext that supports linking graphics, sound and video elements, in addition to text elements. The World Wide Web is a partial hypermedia system, since it supports graphical hyperlinks and links to sound and video files. Most CD-ROMs represent full hypermedia systems.

Hypertext: a special type of computer database system in which objects (text, pictures, music and so on) can be creatively linked to each other. When an object is selected, all other objects linked to it are visible. Hypertext systems are particularly useful for organizing and browsing through large databases consisting of disparate types of information.

Interactivity: the process of communication between two or more points that directly affects the subsequent sequence of events. Interaction does not occur between people only. In an optimal technology-enhanced learning environment, the following four types of interaction occur: between the instructor and learner; between the learner and the technology; between the learner and the materials; and among several learners.

Integrated Services Digital Network (ISDN): an international communications standard for sending audio, video and data over digital telephone lines. Using special metal wires, ISDN supports data transfer rates of 64 Kbps (64,000 bits per second). Most ISDN lines offered by telephone companies provide two lines (called B channels) at once. One line can be dedicated to voice and the other for data, or both lines can be used for data to provide data transfer rates of 128 Kbps. This enables faster transmission of all data.

Internet: a global "electronic" web connecting more than one million computers. Currently, the Internet has more than 50 million users worldwide, and that number is growing rapidly. More than 100 countries are linked into exchanges of data, news and opinions. Unlike online services (such as CompuServe or America Online), which are centrally controlled, the Internet is decentralized by design. Each Internet computer, called a host, is independent. Its operators can choose which Internet services to provide to its local users, and which local services to make available to the global Internet community.

Internet relay chat (IRC): a system that has become very popular as more people are connected to the Internet because it enables people connected anywhere on the Internet to join in live discussions. Unlike older chat systems, IRC is not limited to just two participants. To join an IRC discussion, one needs an IRC client and Internet access. The IRC client is a software program that runs on a personal computer, and sends and receives messages to and from an IRC server. The IRC server, in turn, is responsible for making sure that all messages are broadcast to everyone participating in a discussion. There can be many discussions going on at once; with one assigned a unique channel.

Intranet: a network based on the standard Internet transfer protocol known as TCP/IP belonging to an organization, usually a corporation, and accessible only by the organization's members, employees, or other authorized users. An Intranet's Web site may look and act just like any other Web site, but the firewall surrounding an Intranet prevents unauthorized access. Like the Internet itself, intranets are used to share information. Secure intranets are now the fastest-growing segment of the Internet, because they are much less expensive to build and manage than private networks based on proprietary protocols.

Listserver: an automatic mailing system situated on a host computer that is usually devoted to a specific subject or discipline. When e-mail is addressed to a Listserv mailing list, it is automatically broadcast to everyone on the list. The result is similar to a newsgroup or forum, except that the messages are transmitted as e-mail and are therefore available only to individuals on the list. In comparison, newsgroup messages are available to everyone on the Internet.

Local area network (LAN): a computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings. However, one LAN can be connected to other LANs over any distance via telephone lines and radiowaves. Most LANs connect host computers and personal computers. Each node (or individual computer) in a LAN has its own central processing unit with which it executes programs, but it also provides access to data and devices anywhere on the LAN. This means that many users can share expensive devices, such as laser printers, as well as data. Users can also use the LAN to communicate with each other, by sending e-mail or engaging in chat sessions.

Multimedia: the use of a computer system to present text, graphics, video, animation and sound in an integrated manner. Long touted as the future revolution in computing, multimedia applications were, until the mid-1990s, uncommon due to the expensive hardware required. With recent increases in performance and decreases in price, however, multimedia is finding its way into the mainstream of personal computer applications. To date, most multimedia titles have been games or reference works, but we can expect other types of applications in the future. Due to the electronic storage demands of multimedia applications, the most effective storage media are CD-ROMs.

Multi-mode: the use of more than one technology to deliver instruction, with the technologies selected to complement each other's advantages and limitations. It may also be known as "mixed mode." For example, a course delivered by print and audioconferencing is considered multi-mode.

Network: a group of two or more computer systems linked together. Types of computer networks include LANs, WANs and the Internet. Computers and devices that allocate resources for a network are called "servers." See "Client/Server Application."

Newsgroup: an online discussion group available to all Internet users, usually devoted to a specific subject or discipline. On the Internet, there are literally thousands of newsgroups covering every conceivable interest. To view and post messages to a newsgroup, you need a news reader (a software program now packaged with all software programs that enable Internet connections). See "Listserv."

Node: an individual computer connected to a network.

Proxy: a server sitting between a client application, such as a Web browser, and a real server. It intercepts all requests to the real server to see if it can fulfill the requests itself. If not, it forwards the request to the real server. Proxy servers are used to improve the performance of computer networks, and to filter requests.

Push: in a client/server application to send data to a client without the client requesting it. The World Wide Web is based on a pull technology where the client browser must request a Web page before it is sent. Broadcast media, on the other hand, are "push" technologies because they send information out regardless of whether anyone is tuned in. Increasingly, companies are using the Internet to deliver information push-style. One of the most successful examples of this is PointCast, which delivers customized news to users' desktops. Probably the first and most widely used push technology is e-mail. This is a push technology because you receive mail whether you ask for it or not — that is, the sender pushes the message to the receiver.

Synchronous transmission: a form of usually high-speed data communication that uses synchronization bytes instead of start or stop bits to tell the receiving device about the coming transmission. Synchronous transmission is more complex than asynchronous transmission.

Teleconferencing: a communications configuration using electronic transmission technologies (audio and/or video) to hold live meetings between geographically dispersed individuals. Audioconferencing, videoconferencing and desktop videoconferencing are types of teleconferencing.

Uniform Resource Locator (URL): the global address of documents and other resources on the World Wide Web. The first part of the address indicates what protocol to use, and the second part specifies the IP (Internet protocol) address or the domain name server where the resource is located. For example, the Saskatchewan education services web site is located at: **http://www/sasked/gov.sk.ca**.

Virtual reality: an artificial environment created with computer hardware and software, and presented to the user in such a way that it looks and feels like a real environment. To "enter" a virtual reality, a user dons special gloves, earphones, and goggles, all of which receive their input from the computer system. In this way, at least three of the five senses are controlled by the computer. In addition to feeding sensory input to the user, the devices also monitor the user's actions. The goggles, for example, track how the eyes move and respond accordingly by sending new video input. To date, virtual reality systems require extremely expensive hardware and software and are confined mostly to research laboratories.

Wide area network (WAN): a computer network that spans a relatively large geographical area. Typically, a WAN consists of two or more local-area networks (LANs).
Computers connected to a wide-area network are often connected through public networks, such

as the telephone system. They can also be connected through leased telephone or cable lines or satellites. The largest WAN in existence is the Internet.

World Wide Web (WWW): a system of Internet servers that support documents specially formatted in a language called HTML (HyperText Markup Language). HTML supports links to other documents, as well as graphics, audio and video. By clicking on hyperlinks or hot spots, one can easily move from one document to another. Not all Internet servers are part of the World Wide Web. There are several applications called Web browsers that make it easy to access the World Wide Web — three of the most popular being Mosaic, Netscape Navigator and Microsoft's Internet Explorer.

Appendix D
Roles and Responsibilities of Partners

The table below provides a framework for identifying broad roles and responsibilities of current and potential partners for developing and maintaining a technology-enhanced learning environment. The categories are arbitrary, but they are intended to stimulate discussion.

Three roles are identified and classified as follows:

- **advisory:** provide relevant information for decision-making and action;
- **executive:** make decisions and/or direct the activities of others; and
- **contributing:** support, supply, build, create or deliver goods and services for TEL.

The main areas of responsibility are defined broadly as follows:

- policy (plans, priorities, strategies)
- products (content, design, production)
- pedagogy (instructor and learner)
- promotion (sales/communication)
- infrastructure (cabling and hardware)
- network (a "Learning Network")
- human resources (personnel, expertise)
- material resources (equipment, facilities);
- financial resources (grants, loans, investments)
- access (local, rural, northern, and equitable access).

The following chart lists the **key** "partners" in the initiative and describes their **essential** roles and responsibilities. The chart is not exhaustive: it neither lists **all** the partners nor describes **all** possible roles or responsibilities.

Key Partners	Essential Roles and Responsibilities	Comments
Post-Secondary Education and Skills Training (including the Provincial Apprenticeship Board)	• Advise on TEL network infrastructure. • Determine and promote TEL policy. • Determine the configuration of a Learning Network infrastructure. • Contribute human, material, and financial resources to TEL.	Overall leadership, policy alignment and financial support.

Key Partners	Essential Roles and Responsibilities	Comments
University of Saskatchewan, University of Regina, and Saskatchewan Institute of Applied Science and Technology administration (including all affiliated and federated colleges)	• Advise on TEL policy and learning network infrastructure. • Direct the development of TEL products and processes. • Enable faculty to participate in TEL development. • Contribute human, financial and material resources to TEL.	Commitment by the large institutions is critical to the success of the initiative.
Regional Colleges administration	• Advise on TEL policy and learning network infrastucture. • Advise on TEL product development. • Provide access to TEL for rural and northern residents.	Regional access.
Aboriginal institutions administration	• Advise on TEL policy, product and network development. • Provide access to TEL for Aboriginal people.	Equity.
Faculty and instructional designers	• Identify, then act to resolve pedagogical issues relating to TEL. • Develop TEL products and processes.	Locus of expertise for product development.
Saskatchewan Communications Network	• Advise on TEL policy and learning network infrastructure. • Promote TEL. • Broker and manage Learning Network services. • Contribute human, material, and financial resources to TEL.	Technical centerpiece of the initiative. Significant expansion of current role is required.
Saskatchewan Education (including the Correspondence School)	• Advise on pedagogical and network policy relating to TEL. • Ensure that K-12 policies and TEL are compatible. • Develop and promote TEL products, processes and services. • Contribute human, material, and financial resources to TEL.	Policy and resource support.
K-12 School Divisions	• Provide local access as required.	Local access.

Key Partners	Essential Roles and Responsibilities	Comments
Saskatchewan Economic and Cooperative Development (including agencies like the Saskatchewan Opportunities Corporation, Saskatchewan Trade and Export Partnership, Saskatchewan Research Council, and the Regional Economic Development Authorities)	• Ensure that economic development policies are compatible with TEL. • Promote and market Saskatchewan TEL products and processes; recognize and promote TEL development as a form of economic development. • Provide financial resources to TEL.	Policy and resource support.
SaskTel, cable companies	• Advise on the development and management of a Learning Network. • Ensure corporate policies that support TEL. • Provide required infrastructure and services to support TEL.	Infrastructure development.
Provincial Library/regional libraries	• Advise on development of a provincial Learning Network. • Provide human and material resources to support TEL. • Provide access as required.	Network development and material resources.
Private sector trainers	• Advise on pedagogical matters relating to TEL. • Develop TEL products.	Product development.
Information technology, telecommunications, new media, and software development industries	• Advise on TEL network infrastructure. • Advise on development of a Learning Network. • Develop TEL products. • Contribute human, material, and financial resources to TEL.	Private sector involvement at all levels of the initiative is critical in the long term.
Federal government (including Human Resources Development Canada Office of Learning Technologies, Industry Canada, and others)	• Ensure federal policies that support Saskatchewan's TEL initiative. • Promote TEL. • Provide financial resources to TEL.	Policy and resource support.

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